NATIONAL
FRUIT AND CIDER INSTITUTE,

LONG ASHTON,

NEAR BRISTOL.

REPORT

FOR THE YEAR

1911.

BATH:

PRINTED BY WILLIAM LEWIS & SON, 12, NORTH GATE.

The National Fruit and Cider Institute

LONG ASHTON, NEAR BRISTOL.

REPORT OF THE GOVERNORS

To the Ninth General Meeting of Governors, Members and Associates to be held in the Council Pavilion of the Bath and West and Southern Counties Society, Show Yard, Bath, on THURSDAY, MAY 23rd, 1912, at 3.15 p.m.

Governors of the Institute :

ACLAND, Sir C. T. DYKE-, Bart., (Chairman)
BAKER, G. E. LLOYD-
BIFFEN, R. H.
BULMER, H. P.
BUNYARD, G.
DAVIS, HERBERT J.
ELLIOTT, Sir THOMAS, K.C.B.
GIBBONS, H. H.
GRANT. W. J.
GRENVILLE, R. NEVILLE-
HOBHOUSE, RIGHT HONOURABLE H.
HUNT, A. E. BROOKE-
NAPIER, H. B.
OSBOURNE, J. S. SMYTH-
PRICE, A. T.
RILEY, JOHN
SILLIFANT, A. O.
STRACHIE, THE RIGHT HON. LORD
TAYLOR, MONTAGU C. H.
WATTS, JAMES
WHEELER, E. VINCENT V.
WOLLASTON, G. H.
WOOTTON, JOHN H.
(One Vacancy).

Managing Committee :

NAPIER, H. B. (Chairman)
BULMER, H. P.
GRENVILLE, R. NEVILLE-
OSBOURNE, J. S. SMYTH-
STRACHIE, THE RIGHT HON. LORD
WATTS, JAMES
WOOTTON, JOHN H.

Members :

ACLAND, Sir C. T. D., Bart. Killerton, Exeter.
AMORY, LUDOVIC H. Knightshayes Court, Tiverton.
APPERLEY, H. W. Sandlin, Leigh Sinton, Malvern.
ARCHER, JAMES. 16, Charleville Circus, Sydenham.
BAKER, G. E. LLOYD-. Hardwicke Court, Gloucester.
BATTEN, H. CARY (Colonel). Leigh Lodge, Abbotsleigh, Bristol.
BERKELEY HUNT AGRICULTURAL SOCIETY. Berkeley, Gloucester.
BOND, E. W. Hele, Cullompton, Devon.
BREWERS' EXHIBITION (ARTHUR T. DALE). 46, Cannon Street, London, E.C.
BRISTOL & DISTRICT MARKET GARDENERS' ASSOCIATION. The Grove, Fishponds, Bristol.
BULMER, E. F. Ryelands, Hereford.
BULMER, H. P. Ryelands, Hereford.
BUNYARD, G. Royal Nurseries, Maidstone.
CALEY, A. J. & SON, Ltd., Norwich.
CHEVALLIER, J. B. Aspall Hall, Debenham, Suffolk.
CHILDS, CHRISTOPHER. Boscarn, Love, R.S.O., Cornwall.
CLIFFORD, THE RIGHT HON. LORD, Ugbrooke, Chudleigh, Devon
COUTTS, H. BURDETT MONEY. Stoodleigh Court, Tiverton.
CRAWSHAY, F. W. (Captain). Hempnall House, Hempnall, Norfolk.
CURRE, W. E. C. (Colonel). Itton Court, Chepstow.
DANKS, R. M. Charlton House, Hartlebury, Worcester.
DART, C. Broadhembury, Honiton, Devon.
DAUBUZ, J. C. Killiow, Truro, Cornwall.
DAVIS, HERBERT J. Sutton Montis, Sparkford, Somerset.
DOWDEN, J. MOSTYN. Messrs. Dowden & Pook, 41, Bermondsey Square, London.
DURHAM, H. E. (Dr.) Sunnyside, Broomy Hill, Hereford.
ELLIOTT, Sir THOMAS H., K.C.B. Board of Agriculture and Fisheries, 4, Whitehall Place, S.W.

Members *(continued).*

ELLIS, HENRY ARTHUR. Highman, Gloucester.
FARWELL, E. W. 11, Laura Place, Bath.
FLETCHER, E. Hazeldine, Rydes Hill, near Guildford.
GARTON, J. W. Clarendon Park, Salisbury.
GIBBONS, H. H. Church Farm, Clutton, Bristol.
GIBBS, H. M. Barrow Court, Somerset.
GILBEY, Sir WALTER, Bart. Elsenham Hall, Essex,
GOULTON, WM. 1A, Grove Park Road, South Tottenham, London, N.
GRANT, W. J. County Council Offices, Newport.
GRENVILLE, R. NEVILLE-. Butleigh Court, Glastonbury, Somerset.
GREW, JAMES. Co. Armagh Cider Co., Portadown, Ireland.
HANCOCK, H. C. The Court, Milverton, Taunton.
HART, ALEX. Brooklands, Blackburn.
HAYDON, H. COURTENAY. Chettiscombe, Tiverton, Devon.
HINCKES, R. T. Foxley, Hereford.
HOBHOUSE, RT. HON. H. Hadspen House, Castle Cary, Somerset.
HURLE, J. COOKE. Brislington Hill, Brislington, Somerset.
JEFFREY, ROBERT. The Throsk, Succoth Place, Murrayfield.
JONES, JOSEPH. Coton House, Wolverhampton.
KEEL, WALTER W. Stanton Drew, Bristol.
KELLY, A. L. (Major). Cadbury House, North Cadbury, Somerset.
MARSHALL, L. H. Chippenham, Wilts.
MID-SOMERSET AGRICULTURAL SOCIETY. Shepton Mallet.
MOLE, H. B. Royal Albert Brewery, Queen's Road, Reading.
MONMOUTHSHIRE CHAMBER OF AGRICULTURE. Newport.
NAPIER, H. B. Estate Office, Long Ashton, Bristol.
NORTH SOMERSET AGRICULTURAL SOCIETY (F. W. HUNT). 26, Nicholas St., Bristol.
OSBORN, C. Woolston, North Cadbury, Somerset.
OSBOURNE, J. S. SMYTH-. Ash, Iddesleigh, N. Devon.
PIGOTE, MRS, AGNES SMYTH. Brockley Hall, Somerset.
PITT, WM. Southstoke House, near Bath.
POWER, THOMAS. Dungarvan, Waterford, Ireland.
PRICE, M. PHILIP. Tibberton Court, Gloucestershire.
RADSTOCK AND DISTRICT SMALL HOLDINGS SOCIETY, LTD. (Secretary, A. P. Grenfell, Wynbee Hall, 28, Commercial Street, Radstock, Somerset).
RANKIN, Sir JAMES, Bart., M.P. Bryngwyn, Hereford.
RILEY, JOHN. Putley Court, Ledbury.
ROOTES, CHARLES, c/o Messrs. Pulling & Co., Bath Street, Hereford
ROYAL JERSEY AGRICULTURAL SOCIETY. Jersey.
RUSSELL, S. G. Dumper's Farm, Chew Magna, Somerset.
SHELLEY, Sir JOHN, Bart. Shobrooke Park, Crediton, Devon.
SHERSTON, C. D. (Major). Evercreech, Bath.
SILLIFANT, A. O. Culm Leigh, Stoke Canon, Exeter.
SMITH, J. W. Thinghill Court, Hereford.
SOMERSET COUNTY AGRICULTURAL ASSOCIATION. Taunton.
SOMERVILLE, A. F. Dinder, Wells, Somerset.
STEWART, J. FINLAY. Aish Cross House, near Totnes, Devon.
STIRLING, JAMES L. 18, Eustace Street, Dublin.
STOOKE, J. E. HELLYAR. 2, Palace Yard, Hereford.
STRACHIE, The RIGHT HON. LORD. Sutton Court, Pensford, Bristol.
SUTTON, LEONARD G. Hillside, Reading.
SYMONS, JOHN & Co., Ltd. Totnes, Devon.
TAUNTON DEANE HORTICULTURAL AND FLORICULTURAL SOCIETY. Taunton Deane, Somerset.
THOMAS, AUBREY (Lieut.-Col.). Overross, Hereford.
TILLEY, L. H. Banham, near Attleborough, Norfolk.
TILLEY, W. T. S. East Compton, Shepton Mallet.

Members *(continued).*

TREDEGAR, The RIGHT HON. VISCOUNT, Tredegar Park, Newport.
VANDELEUR, THOS. P. Par Station, Cornwall.
WALLIS, W. Tewkesbury, Gloucester.
WARDLAW, H. Holway Farm, Sherborne, Dorset.
WARREN, RICHARD A. Belle Vue, Harrow Road, Worcester.
WATTS, JAMES. Backwell, near Bristol.
WHEELER, E. VINCENT V. Newnham Court, Tenbury, Worcestershire.
WHISH, E. BARCLAY. The Cottage, East Cranmore, Shepton Mallet.
WHITEWAY, HENRY. Fordron House, Whimple, Devon.
WILLIAMS, T. W. Bank Chambers, Corn Street, Bristol.
WILSON & CO., LTD. Frome, Somerset.
WOLLASTON, G. H. Flax Bourton, Bristol.
WOOTTON, JOHN H. Byford, Hereford.
WRIGHT, H. STUART. The Grange, Long Ashton, Bristol.

Associates:

ALLEN, J. D. Springfield, Shepton Mallet.
ALLISON, J. B. Rock Villa, Burrowbridge, Bridgwater.
ASHFORD, A. W. West End Farm, Chedzoy, Bridgwater.
BARTLETT, FELIX PAUL. Riviera, Brixham, Devon.
BATTEN, GEORGE. Rosebank, Pensford, Bristol.
BAX, ALFRED. Barrow Gurney, Somerset.
BELL, F. A. Wellow House, Wellow, Newark.
BIRD, WILLIAM. The Nest, Overndale Road, Fishponds, Bristol.
BLINMAN, H. T. Farrington Gurney, Somerset.
BRITTEN, J. E. Old Wood, Tenbury, Worcester.
BROOK, CHARLES. Marksbury, Somerset.
BROWN, ALEXANDER. Court Farm, Failand, near Bristol.
BUTLER, WILLIAM. Gatcombe Farm, Long Ashton.
CARPENTER, F. M. Whitecross Court, Whitchurch, Somerset.
CARTER, FREDERICK J. Failand Farm, Failand, Bristol.
CAZALET, R. H. The Bannut Tree House, Castlemorton, Malvern, Worcester.
CHAPMAN, WALTER. Hewish, Bristol.
CHILD, FREDERICK. Hazels Farm, Wraxall, Somerset.
CHOLMELEY, H. C. FAIRFAX. Brandsby, Easingwold, York.
CROFTS, JOHN. Sutton Montis, Sparkford, Somerset.
DAVIES, DAVID. Gable Farm, Wraxall, Somerset.
DAVIES, JAMES. Marden, near Hereford.
DAVIS, WILLIAM, Highbridge Farm, Dundry, Bristol.
DE GOOSH, ARTHUR W. Kimball Buildings, 18, Tremont Street, Boston, U.S.A.
ELEY, JOHN P. Mays Hill, Frampton Cotterell, near Bristol.
FOWLES, L. E. Wallwyn Court, Much Marcle, Hereford.
GILES, JOHN. Portbury, Bristol.
GRIPPER, H. P. Myrtle House, Bradpole, Bridport, Dorset.
HAM, CHARLES. 44, Mary Arches Street, Exeter.
HARDING, RICHMOND. Fenswood Farm, Long Ashton.
HOWLAND, A. T. Sunnybrook Fruit and Bee Farm, Beckford, near Tewkesbury.
HUNT, WALTER. Easton-in-Gordano, Somerset.
JONES, GEORGE. Wood Farm, Welland, Malvern.
KNIGHT, R. P. Bridge Farm, Whitchurch, Somerset.
LANGFORD, E. W. Wyebridge Stores, Hereford.
MCCREATH, W. D. Quantock Vale Cider Works, North Petherton, Bridgwater.
MISSEN, GEORGE. Shrubberts Farm, Backwall Common, Bristol.
MORGAN, THE REV. ELDRED. The Rectory, Flax Bourton, Somerset.
PARSONS, GEORGE. Long Ashton, Somerset.
PATCH, CHARLES. "Fox and Goose," Barrow Gurney, Somerset.
PATCH, ERNEST PHILIP. Long Ashton, Somerset.

PEARCE, ALFRED JAMES. Reservoir Farm, Barrow Gurney, Somerset.
PEARCE, JOHN. Hilltop Farm, Barrow Gurney, Somerset.
PERHAM, WM. EDWARD. Flax Bourton Court, Bristol.
POPE, JOHN M. Spence Combe, Copplestone, Devon.
POWELL, J. J. S. Hall Court, Much Marcle, Hereford.
PRETTY, W. H. 4, The Terrace, Shirehampton, Bristol.
PROCTOR, MRS. Gatcombe Court, Gatcombe, Bristol.
PULLIN, JOHN W. Compton Greenfield, near Bristol.
REID, HUGH. Long Ashton, Bristol.
REYNOLDS, EDWIN. Redwood Farm, Barrow Gurney, Somerset.
RIDLER, R. E. Clehonger Manor, Hereford.
RILEY, W. A. 100, King Street, Norwich.
RIPLEY, E. G. Beaston House, Bucknall, Shropshire.
STONE, THOS. Wine and Cider Merchant, Axminster
STUCKEY JAMES. Whare Rod, Bedford.
SYMES, J. H. Coat Farm, Martock, Somerset.
SUTTON, WILLIAM LINCOLNE. Eaton, Norwich.
TAVENER. GEORGE E. Budlake, Broadclyst, Devon.
TAYLOR, HENRY. Rudge Farm, Long Ashton, Bristol.
THOMPSON, ERNEST H. Gilmorton, Tenbury, Worcester.
TUCKETT, PHILIP D. Netherton, near Newton Abbott.
TUDWAY, C. C. Wells, Somerset.
TURNER, J. S. Dowland Barton, Dolton, Devon.
TURNER, WM. Heath Barton, Pinhoe, Exeter.
VESSEY, EDGAR C. 19, Cotham Grove, Bristol.
VICKERY GEORGE. 6, Portman Terrace, Cheddon Road, Taunton.
VOWLES, CHAS. ELLIOTT. School Farm, Barrow Gurney, Somerset.
VOWLES, ERNEST. Upper Mill, Barrow Gurney, Somerset,
WALKER, J. S. Fern Lodge, Beech Road, Weston-super-Mare.
WALKEY, C. E. J. Edgeborough, Staplegrove, Taunton.
WALL, JOHN. Crickham, Wedmore, Somerset.
WARREN, CYPRIAN A. 8, Lichfield Gardens, Richmond, Surrey.
WELLS, EDGAR H. Ford, Wellington, Somerset.
WESTON, HENRY. Bounds Farm, Much Marcle, Hereford.
WILSON, JAMES. Freeman's Farm, Barrow Gurney, Somerset.
WOODGATE, G. A. Gattertop, Leominster.

Life Member :

HUNT, A. E. BROOKE-. 2, Augusta Gardens, Folkestone.

Hon. Members.

Secretary, Devon Agricultural Education Committee.
" Gloucester " " "
" Hereford " " "
" Somerset " " "
" Worcester " " "

BIFFEN, R. H. The Gables, Histon, Cambridge.
LLOYD, F. J. Muscovy House, Trinity Square, London, E.C.
WALKER, E. G. F. The Hollies, Chewstoke, Bristol.

Resident Director :

B. T. P. BARKER, M.A. The National Fruit and Cider Institute, Long Ashton, Bristol.

Superintendent of Fruit Department :

J. ETTLE, F.R.H.S. Stanley Grove Road, Weston-super-Mare.

Hon. Treasurer :

H. B. NAPIER. Estate Office, Long Ashton, Bristol.

Hon. Secretary :

W. J. GRANT. County Council Offices, Pentonville, Newport, Mon.

REPORT BY THE GOVERNORS.

1. The Governors beg to submit to the Members the following Report on the work of the Institute during the past year.

2. The Institute has been founded and is maintained by the following Bodies :—

The Board of Agriculture and Fisheries.
The Bath and West and Southern Counties Society.
Devon County Council.
Gloucester County Council.
Hereford County Council.
Monmouth County Council.
Somerset County Council.
Worcester County Council.

3. Since the formation of the Institute, new Members and Associates have been enrolled each year, and the Governors hope that as the work and objects of the Institute become more widely known there will be a steady increase in the number of both Members and Associates. Members and Associates.

4. In accordance with Article 30 of the Articles of Association, the following Governors retire :—

Governors.	By whom appointed.
Acland, Sir C. T. Dyke	Bath and West Society.
Biffen, R. H.	University of Cambridge.
Bunyard, G.	Royal Horticultural Society.
Elliott, Sir Thomas H. ..	Board of Agriculture.
Grant, W. J.	Monmouthshire County Council.
Price A. T.	Gloucester County Council.
Sillifant A. O.	Devon County Council
Wollaston G. H...	University College, Bristol.

These Governors are eligible for re-nomination by the various bodies whom they represent.

5. The Governors and Managing Committee wish to impress upon the Counties concerned, and upon all persons interested in the important industry of Cider-making the advantages of the opportunity now placed at their disposal, through the formation of the Institute, by means of which they may obtain advice and assistance bearing upon this Advantages of Institute.

industry, either by personally visiting the Institute, or by sending their sons there to receive instruction, scientific and practical, not only in Cider and Perry-making, but also in the growth of fruit and the production of fruit trees.

Terms.

6. Students can be received on the following terms :—

Scientific instruction in the Laboratory :—

Four guineas for one month's instruction ; or

Ten guineas for three months' instruction.

Working pupils from subscribing Counties can be received at the Institute for a period of not less than one year for instruction upon Fruit-growing, and to work upon the Farm. Pupils to receive a wage of 7s. 6d. per week from the Institute, the Counties sending the pupils to contribute a Scholarship of £20 per annum.

Distribution of Cider Apple and Perry Pear Trees.

7. 215 trees have again been distributed during this season (1911) for the purpose of establishing, what might be termed, the best examples of Cider and Perry Orchards.

Practical Work.

8. In October and November, 1911, the Cider-making months, a large number of those interested in the West country industry of Cider-making availed themselves of the opportunity of visiting the Institute.

Inspection of Institute, Fruit Nursery and Plantation.

9. Since the last Report the Institute has been inspected by those who are interested both in the Cider industry and Fruit Culture from many counties, all of whom seemed to be thoroughly impressed with the very practical and thorough manner in which the making of Cider was carried out, and also in the production of the best Cider Apples and Perry Pears, which are being grown in the Nursery attached to the Institute.

Object Lesson

10. With a view of extending the usefulness of the Institute arrangements were made by which exhibits from an educational standpoint were sent to the following Shows :—

Bath and West and Southern Counties Society's, Cardiff.
Royal Agricultural Society's, Norwich.
Brewers' Exhibition, London.
Hereford and Worcester Agricultural Society's.
Mid-Somerset Agricultural Society's.
Somerset County Agricultural Society's.
Gloucester Agricultural Society's.

Hereford County Council.
Monmouth County Council.
Devon County Agricultural Society's.
Bristol and District Agricultural Development Association.

Annual Tasting Day.

11. A thoroughly representative, and certainly one of the largest, gatherings that has yet taken place at the Institute, met on Thursday, 2nd May, 1912, for the purpose of inspecting the Fruit plantations, seeing the work that was being done, and tasting the Cider and Perry made from Fruit grown in the various Cider counties.

Mr. Barker, as on previous occasions after the tasting, gave to an interested audience, an address on the selection and planting of varieties of Apples for Cider making, while Mr. Ettle addressed those present as to the treatment of Orchards from an agricultural and commercial standpoint; in this way the Visitors had an excellent opportunity of forming some ideas as to the value of the work that was being carried out in connection with the Institute.

12. The Governors take this opportunity of requesting all who are either interested in the Institute or in the work it is doing, to use their influence in urging others to become Members. Members' subscriptions are one guinea per annum, for which they receive all the literature published by the Institute, and can have either six varieties of Apples or Pears or six kinds of Cider or Perry analysed each year. They are also able to purchase Cider Apple and Perry Pear Trees raised at the Institute to the number of 100 per annum at the rate of 2s. per tree (to Non-members the price is 2s. 6d. per tree) as far as the supply permits. Grafts and buds of apples and pears are also available. Associates' subscriptions are 5s. per annum. They have the same privileges, with the exception that they are unable to vote at the Annual Meeting; while both Members and Associates can visit the Institute and obtain advice from Mr. B. T. P. Barker, upon all matters in connection with the Cider industry.

13. In the Appendix will be found a Report upon the work of the Institute during 1911 from Messrs. B. T. P. Barker and J. Ettle.

W. J. Grant,
Hon. Sec.

THE NATIONAL FRUIT AND CIDER INSTITUTE.

CASH ACCOUNT FOR THE YEAR 1911.

To GRANTS—									
Board of Agriculture			£550	0	0				
Bath and West of England Society			100	0	0				
Devon County Council			100	0	0				
Gloucester County Council			100	0	0				
Somerset County Council			100	0	0				
Worcester County Council			100	0	0				
Monmouth County Council			50	0	0				
						1100	0	0	
To AFFILIATION FEES.									
Berkeley Hunt Agricultural Society			1	1	0				
Brewers' Exhibition			1	1	0				
Bristol University			1	1	0				
Bristol and District Market Gardeners' Association			1	1	0				
Mid-Somerset Agricultural Society			1	1	0				
Monmouth Chamber of Agriculture			1	1	0				
North Somerset Agricultural Society			1	1	0				
Royal Jersey Agricultural Society			1	1	0				
Somerset Agricultural Society			1	1	0				
Taunton Deane Horticultural Society			1	1	0				
						10	10	0	
To MEMBERS' SUBSCRIPTIONS						80	17	0	
To ASSOCIATES' SUBSCRIPTIONS						14	15	0	
To MISCELLANEOUS RECEIPTS—									
Harding R., Grazing Rent			9	10	0				
Lloyds Bank, Interest			6	7	3				
Devon County Show towards Expenses			2	2	8				
						17	19	11	
To SALES						263	16	3	
To Balance due to Bank						83	2	9	

We certify that the above is a true extract from the Cash Book of the National Fruit and Cider Institute.

(Signed) CURTIS, JENKINS & CO.,

By Balance due to Bankers								£19	15 7
By SCIENTIFIC STAFF AND EXPENSES—									
Barker B. T. P., Salary				£350	0	0			
Camps W.				17	18	8			
Sundry Bills and Expenses				41	8	7			
							409	7	3
By RENTS, RATES, etc.—									
Ashton Court Estate, Rent				80	0	0			
Insurance				1	18	3			
Rates and Taxes				26	13	11			
							108	12	2
By Buildings Account Additions				1	16	3			
Machinery, Plant, etc. „				24	19	7			
Laboratory Fittings „				8	19	4			
							35	15	2
By MANAGEMENT ACCOUNT—									
Accountant and Correspondents				32	10	0			
Secretarial Postages and Expenses				7	14	8			
Treasurer's Postages				3	9	10			
Printing, Stationery, etc.				62	2	4			
							105	16	10
By ORCHARDS, NURSERY & PLANTATION ACCOUNT—									
Labour				282	14	1			
Trees, Manure, etc.				53	10	6			
Superintendent's Honorarium and Expenses				49	8	5			
							385	13	0
By CIDER MAKING ACCOUNT—									
Labour				83	8	0			
Apples, Carriage, etc.				184	8	8			
Cider Maker				38	14	4			
							306	11	0
By SPRAYING EXPERIMENTS—									
Greenhouse				128	5	0			
Sundries				12	12	9			
							140	17	9
By MISCELLANEOUS ACCOUNT—									
Show Expenses and Sundries							58	12	2
							£1571	0	11

Balance Sheet, 31st December, 1911.

Liabilities.	£	s.	d.	*Assets.*	£	s.	d.	£	s.	d.
Overdraft on Bankers	83	2	9	PROPERTY ACCOUNT—						
Revenue Account Balance	730	11	7	Buildings	17	9	0			
				Machinery, Plant, etc.	113	19	7			
				Laboratory fittings	35	8	0			
								166	16	7
				STOCKS—						
				Nursery	492	13	8			
				Cider	125	0	0			
								617	13	8
				Sundry Debtors, as per Sales Ledger				29	4	1
	£813	14	4					£813	14	4

(Signed) G. E. LLOYD BAKER,
JAMES WATTS, } Governors.

Auditors' Report.—We report that we have audited the Books and Accounts of the Institute for the year ended 31st December, 1911, together with the Balance Sheet made up as on that day and above set forth. All the information and explanations required have been furnished us. In our opinion the Balance Sheet above referred to is properly drawn up so as to exhibit a true and correct view of the state of the Institute's affairs according to the best of the information and explanations supplied to us, and as shown by the books of the Institute.

Bristol; 29th April, 1912.

(Signed) CURTIS, JENKINS & CO.,
Chartered Accountants.

APPENDIX.

REPORT BY B. T. P. BARKER, M.A., *Director.*

AND

J. ETTLE, F.R.H.S., *Superintendent of the Fruit Department.*

In the following report of the work of the Institute there has been no attempt to provide a record of all work carried on there during the past twelve months. For the most part the problems now under investigation are not of a character to yield immediate results, and a *résumé* of the details of work actually performed in connection with each subject is not likely to be of much general interest or profit. Therefore reference will be made only to a few subjects which have furnished more or less definite results.

Some extension of the work has been possible during the past year owing to the annual grant received from the Board of Agriculture having been increased from £300 to £450. In addition the Board made a special grant of £100 towards the cost of a greenhouse which it was necessary to erect for the purpose of certain investigations on plant diseases and their treatment. It is probable that in the near future considerable further extension will occur, since the Board of Agriculture has intimated that it is prepared, under certain conditions and in the event of the association of the Institute with Bristol University, to make a substantial grant from the sum of money placed at its disposal by the Development Commissioners for the purposes of agricultural research. Negotiations with the University have been for some time in progress, and the proposed scheme of association has been provisionally approved. It is anticipated that it will come into working order during the ensuing year.

The character of the work recently undertaken has been largely determined by the prospect of future developments; and much which has been done within the past season or two is preparatory only to extensions on a more ambitious scale than has been previously possible with the limited resources of the Institute hitherto available.

Investigations on Cider-Making.

SINGLE VARIETY TRIALS.

The practice adopted in previous seasons of restricting the work on a practical scale in the cider-house very largely to a series of variety trials has again been followed. Although the character of the results to be obtained from work of this description is necessarily limited, and although probably such information of general application as can be furnished by experiments of this nature has already, for the most part, been provided by the work of the past seven years, there still remains an almost inexhaustible field for investigation among the countless varieties which are to be found in the older cider orchards. That there are still many apples of high vintage merit existing unnoticed is certain. This study is also necessary for the improvement of our vintage orchards in order to demonstrate which varieties are worthless or inferior and ought to be allowed to drop out of cultivation.

This work has, however, been continued for an additional reason. It is not necessary to be constantly testing hitherto untried varieties in order to obtain results of value. Some of the most useful and helpful information obtained from this line of work has been gathered from trials of well-known varieties which had already been frequently examined. Repeated trial, under different conditions, of a fair number of varieties is essential in order that the extent of the variation of the results for an individual variety may be disclosed. Its importance from one point of view alone will be indicated in the following section.

The varieties mentioned in the following list were those tested on a practical scale during the season 1910–11.

CIDERS.

Sharp Varieties—(including those containing normally at ·45 per cent. Malic Acid).

Ashton Long Stem (Somerset).—Analysis of fresh juice, December 14th, 1910: specific gravity 1·052, malic acid 1·05 per cent., tannin ·286 per cent. Weight of fruit 724lbs.; yield of juice 563lbs. Average daily fall in specific gravity at 28°C.. ·0032. Filtered January 9th, 1911: specific gravity 1·036. Specific gravity in bottle, April 27th, 1911: 1·029. A very sharp, somewhat hard cider of very fair flavour and aroma; rather lacking in body. Useful for blending, but much too sharp for use alone.

Dufflin (Cornwall).—Analysis of fresh juice, November 17th, 1910: specific gravity 1·074, malic acid 1·20 per cent., tannin ·208 per cent. Weight of fruit 599lbs.; yield of juice 460lbs. Average daily fall in specific gravity at 28°C., ·0022.

Filtered January 9th, 1911: special gravity 1·036. A very sharp, sweet cider; flavour and aroma very fair and body full. Much too sharp unblended, but excellent for blending.

Dymock Red (Hereford).—Analysis of fresh juice, November 17th, 1910: specific gravity 1·050, malic acid ·55 per cent., tannin ·204 per cent. Weight of fruit, 1,130lbs.; yield of juice 890lbs. Average daily fall in specific gravity at 28°C., ·0032. Filtered January 14th, 1911: specific gravity 1·036. Specific gravity in bottle, April 27th, 1911: 1·033. A medium brisk sweet cider with a slight bettersweet character; flavour and aroma fair and body full. Can be used alone, but rather too coarse for that purpose, and greatly improved by suitable blending.

Forest Styre (Gloucester).—Analysis of fresh juice, November 3rd, 1910: specific gravity 1·060, malic acid 1·01 per cent., tannin ·164 per cent. Weight of fruit, 281lbs.; yield of juice 228lbs. Average daily fall in specific gravity at 28°C., ·0037. Filtered December 19th, 1910: specific gravity 1·029. Specific gravity in bottle, April 27th, 1911: 1·022. A rather thin, very sharp cider of fairly pleasant flavour and aroma, but lacking in body. Too sharp for use alone; useful for blending.

Gatcombe (Somerset).—Analysis of fresh juice, December 15th, 1910: specific gravity 1·055, malic acid ·54 per cent., tannin ·144 per cent. Weight of fruit, 712lbs.; yield of juice 531lbs. Average daily fall in specific gravity at 28°C., ·0038. Filtered January 9th, 1910: specific gravity 1·035. Specific gravity in bottle, April 27th, 1911: 1·031. A very pleasant, sweet, full-bodied cider of moderate acidity; flavour and aroma fruity and good. A very useful cider unblended. The variety is apparently a local sort at Long Ashton, and has not been identified with any named kind. It is a regular and heavy cropper and good grower as well as of value for vintage purposes. It is here named after the farm upon which it is grown.

Greasy Pippin (Somerset).—Analysis of fresh juice, December 15th, 1910: specific gravity 1·053, malic acid 1·08 per cent., tannin ·250 per cent. Weight of fruit, 364lbs.; yield of juice, 288lbs. Average daily fall in specific gravity at 280°C., ·0028. Filtered January 2nd, 1911: specific gravity 1·039. Specific gravity in bottle, April 27th, 1911: 1·038. A rich sweet, very sharp cider of excellent flavour and aroma and full body. Valuable for blending, but this season too sharp for use alone. The variety is also useful for market purposes and deserves to be grown for its dual value.

Kingston Black A. (Hereford).—Analysis of fresh juice, November 17th, 1910: specific gravity 1·061, malic acid ·71 per cent., tannin ·178 per cent. Weight of fruit, 967lbs.; yield of juice 770lbs. Average daily fall in specific gravity at 28°C., ·0054. Filtered December 28th, 1910: specific gravity 1·031. Specific gravity in bottle, April 27th, 1911: 1·027. A medium sweet, brisk cider of fair quality; aroma and flavour very fair, but somewhat hard; body fairly full. A fair cider alone, although rather too brisk and hard.

Kingston Black B. (Hereford).—Analysis of fresh juice, November 17th, 1910: specific gravity 1·063, malic acid ·74 per cent., tannin ·184 per cent. Weight of fruit 907lbs.; yield of juice 703lbs. Average daily fall in specific gravity at 28°C., ·0059. Filtered December 28th, 1910: specific gravity 1·034. Specific gravity in bottle, April 27th, 1911: 1·031. A sweet, brisk cider, resembling the preceding. Very fair alone, but too brisk for some palates.

Kingston Black C. (Hereford).—Analysis of fresh juice, November 17th, 1910: specific gravity 1·062, malic acid ·72 per cent., tannin ·188 per cent. Weight of fruit 749lbs.; yield of juice, 593lbs. Average daily fall in specific gravity at 28°C., ·0060. Filtered December 28th, 1910: specific gravity 1·032.

Specific gravity in bottle, April 27th, 1911 : 1·028. A medium sweet, brisk cider, closely resembling the two preceding.

Kingston Black D. (Hereford).—Analysis of fresh juice, November 17th, 1910 : specific gravity 1·051, malic acid ·60 per cent., tannin ·168 per cent. Weight of fruit, 1,011lbs. ; yield of juice 809lbs. Average daily fall in specific gravity 28°C., ·0043. Filtered December 12th, 1910 : specific gravity 1·035. Specific gravity in bottle, April 27th, 1911 : 1·028. A medium sweet, brisk cider of good quality. Differs somewhat from the preceding, being of rather better flavour and aroma, of less marked briskness, fuller in body, and softer.

Kingston Black (Staplegrove, Somerset).—Analysis of fresh juice, November 17th, 1910; specific gravity 1·062, malic acid ·63 per cent., tannin ·168 per cent. Weight of fruit, 795lbs. ; yield of juice, 621lbs. Average daily fall in specific gravity at 28°C., ·0043. Filtered January 2nd, 1911 : specific gravity 1·036. Specific gravity in bottle, April 27th, 1911 : 1·026. A medium sweet, fairly full-bodied cider of good flavour and aroma and moderate briskness. Differs considerably from the preceding four ciders made from Herefordshire grown fruit. Very useful alone.

Kingston Black (Ilminster, Somerset).—Analysis of fresh juice, November 10th, 1910 : specific gravity 1·065, malic acid ·65 per cent., tannin ·204 per cent. Weight of fruit, 1,078lbs. ; yield of juice, 828lbs. Average daily fall in specific gravity at 28°C., ·0024. Filtered January 9th, 1911 : specific gravity 1·040. Specific gravity in bottle, April 27th, 1911 : 1·033. A good cider resembling the preceding, but of improved flavour and aroma and decidedly fuller in body. Excellent alone.

Kingston Black (Long Ashton, Somerset).—Analysis of fresh juice, November 17th, 1910 : specific gravity 1·058, malic acid ·67 per cent., tannin ·186 per cent. Weight of fruit, 199lbs. ; yield of juice, 158lbs. Average daily fall in specific gravity at 28°C., ·0021. Filtered December 28th, 1910 : specific gravity 1·034. A sweet, brisk cider of good flavour and aroma, but marred somewhat by excessive hardness. Fair alone, but greatly improved by blending with a softer cider.

Lady's Finger (Somerset).—Analysis of fresh juice, November 7th, 1910 : specific gravity 1·046, malic acid ·58 per cent., tannin ·096 per cent. Weight of fruit, 1,345lbs. ; yield of juice, 1,066lbs. Average daily fall in specific gravity at 28°C., ·0072. Filtered November 20th, 1910 : specific gravity 1·034. Specific gravity in bottle, April 27th, 1911 : 1·027. A fairly sweet but thin, medium brisk cider ; flavour and aroma as in preceding seasons of a characteristic peculiar aromatic quality. Can be used alone or blended.

Lambrook Pippin (Somerset).—Analysis of fresh juice, December 14th, 1910 : specific gravity 1·053, malic acid ·65 per cent., tannin ·248 per cent. Weight of fruit, 1,184lbs. ; yield of juice, 912lbs. Average daily fall in specific gravity at 28°C., ·0032. Filtered January 9th, 1911 : specific gravity 1·039. Specific gravity in bottle, April 27th, 1911 : 1·036. A sweet, light, medium brisk cider of pleasing character ; rather thin, but flavour and aroma good. Good unblended, but improved this season by the addition of a fuller-bodied cider.

Page's Yellow (Gloucester).—Analysis of fresh juice, November 3rd, 1910 : specific gravity 1·053, malic acid ·65 per cent., tannin ·134 per cent. Weight of fruit, 437lbs. ; yield of juice, 345lbs. Average daily fall in specific gravity at 28°C., ·0036. Filtered November 20th, 1910 : specific gravity 1·040. Specific gravity in bottle, April 27th, 1911 : 1·037. A sweet, brisk cider of attractive and full-bodied character ; aroma and flavour good. Blending unnecessary, the quality being good enough for use alone. In this instance

brewer's yeast was added to the freshly pressed juice to promote vigorous primary fermentation.

Prince of Wales' Crab (Somerset).—Analysis of fresh juice, December 14th, 1910: specific gravity 1·049, malic acid 1·11 per cent., tannin ·312 per cent. Weight of fruit, 664lbs.; yield of juice, 502lbs. Average daily fall in specific gravity at 28°C., ·0070. Filtered December 28th, 1910: specific gravity 1·031. Specific gravity in bottle, April 27th, 1911: 1·027. A moderately sweet, very acid cider; flavour and aroma moderate; deficient in body, coarse in character, and astringency marked. Not adapted for use alone, but serviceable for blending in small quantities with sweeter full-bodied ciders.

Yellow Styre (Gloucester).—Analysis of fresh juice, November 3rd, 1910: specific gravity 1·059, malic acid ·72 per cent., tannin ·184 per cent. Weight of fruit, 432lbs.; yield of juice, 329lbs. Average daily fall in specific gravity at 28°C., ·0065. Filtered December 5th, 1910: specific gravity 1·027. Specific gravity in bottle, April 27th, 1911: 1·023. A medium sweet, rather sharp cider of good quality; flavour and aroma very fair, but body rather deficient. This season rather too sharp for use alone; good for blending.

SWEET VARIETIES—(including those containing normally less than ·45 per cent. Malic Acid and ·2 per cent. Tannin).

Ashton Brown Jersey (Somerset).—Analysis of fresh juice, December 14th, 1910: specific gravity 1·057, malic acid ·19 per cent., tannin ·194 per cent. Weight of fruit, 650lbs.; yield of juice, 520lbs. Average daily fall in specific gravity at 28°C., ·0055. Filtered December 28th, 1910: specific gravity 1·033. Specific gravity in bottle, April 27th, 1911: 1·030. A sweet cider of fair character; flavour pleasant but thin, with appreciable astringency, and aroma good. Can be used alone, but is improved by blending.

Morgan Sweet (Somerset).—Analysis of fresh juice, October 10th, 1910: specific gravity 1·046, malic acid ·65 per cent., tannin ·160 per cent. Weight of fruit, 2,085lbs.; yield of juice, 1,670lbs. Average daily fall in specific gravity at 28°C., ·0100. Filtered October 31st, 1910: specific gravity 1·003. Specific gravity in bottle, April 27th, 1911: 1·003. A thin, dry cider of coarse and somewhat unpleasant flavour and aroma. Inferior alone; moderate for blending.

Taylor's Bitter (Somerset).—Analysis of fresh juice, November 24th, 1910: specific gravity 1·047, malic acid ·31 per cent., tannin ·202 per cent. Weight of fruit, 1,118lbs.; yield of juice, 849lbs. Average daily fall in specific gravity at 28°C., ·0054. Filtered December 19th, 1910: specific gravity 1·037. Specific gravity in bottle, April 27th, 1911: 1·024. A medium sweet cider of moderate quality; flavour and aroma fair, body deficient, and character lacking. Too characterless for use unblended, but fairly useful for blending.

BITTERSWEET VARIETIES—(including those containing normally less than ·45 per cent. Malic Acid and more than ·2 per cent. Tannin).

Ashton White (Somerset).—Analysis of fresh juice, October 10th, 1910: specific gravity 1·048, malic acid ·22 per cent., tannin ·320 per cent. Weight of fruit, 862lbs.; yield of juice, 678lbs. Average daily fall in specific gravity at 28°C., ·0025. Filtered October 31st, 1910: specific gravity 1·031. Specific gravity in bottle, April 27th, 1911: 1·031. A rather astringent sweet cider of very fair flavour and aroma; lacking in body. Too bitter for use alone; but useful for blending.

Brown Snout (Hereford).—Analysis of fresh juice, November 24th, 1910: specific gravity 1·051, malic acid ·33 per cent., tannin ·324 per cent. Weight of fruit, 885lbs.; yield of juice, 692lbs. Average daily fall in specific gravity at 28°C., ·0046. Filtered December 19th, 1910: specific gravity 1·026. Specific gravity in bottle, April 27th, 1911: 1·023. A medium sweet, pleasant cider of rather bitter character; flavour and aroma very fair and body full. Useful for blending; too bitter unblended.

Chisel Jersey (*Somerset*).—Analysis of fresh juice, December 14th, 1910: specific gravity 1·065, malic acid ·32 per cent., tannin ·720 per cent. Weight of fruit, 736lbs.; yield of juice, 518lbs. Average daily fall in specific gravity at 28°C., ·0040. Filtered January 9th, 1911: specfic gravity 1·050. Specific gravity in bottle, April 27th, 1911: 1·039. A rich, sweet, full-bodied cider of marked bitterness; flavour very fair, but inclined to be coarse, aroma good. Very useful in small quantities for blending; much too bitter alone.

Cummy Norman (Hereford).—Analysis of fresh juice, December 6th, 1910: specific gravity 1·053, malic acid ·19 per cent., tannin ·286 per cent. Weight of fruit, 1,064lbs.; yield of juice, 762lbs. Average daily fall in specific gravity at 28°C., ·0076. Filtered December 19th, 1910: specific gravity 1·033. Specific gravity in bottle, April 27th, 1911: 1·027. A sweet, slightly bitter cider of fair quality; aroma and flavour fair, but rather coarse. Moderately useful for blending, but lacking in character and quality for use alone.

Dabinett (Somerset).—Analysis of fresh juice, December 14th, 1910: specific gravity 1·055, malic acid ·19 per cent., tannin ·242 per cent. Weight of fruit, 201lbs.; yield of juice, 159lbs. Average daily fall in specific gravity at 28°C., ·0080. Filtered December 28th, 1910: specific gravity 1·034. A medium sweet cider of moderate quality; aroma rather coarse, flavour fair with slight astringency and harshness; body thin. Of slight value alone; moderately useful for blending.

Early Red Jersey (Somerset).—Analysis of fresh juice, October 10th, 1910: specific gravity 1·047, malic acid ·17 per cent., tannin ·480 per cent. Weight of fruit, 924lbs.; yield of juice, 732lbs. Average daily fall in specific gravity at 28°C., ·0028. Filtered October 31st, 1911: specific gravity 1·033. Specific gravity in bottle, April 27th, 1911: 1·028. A pleasant, sweet cider of typical bittersweet character; aroma and flavour good; body deficient. Useful for blending; too bitter alone.

Horner (Somerset).—Analysis of fresh juice, November 10th, 1910: specific gravity 1·059, malic acid ·36 per cent., tannin, ·228 per cent. Weight of fruit, 1,021lbs.; yield of juice, 799lbs. Average daily fall in specific gravity at 28°C., ·0040. Filtered December 19th, 1910: specific gravity 1·035. Specific gravity in bottle, April 27th, 1911: 1·024. A medium sweet, mildly bitter cider of very fair flavour and aroma; body full. Fair alone, and good for blending.

Improved Broadleaf (Somerset).—Analysis of fresh juice, December 14th, 1910: specific gravity 1·045, malic acid ·26 per cent., tannin ·446 per cent. Weight of fruit, 1,160lbs.; yield of juice, 868lbs. Average daily fall in specific gravity at 28°C., ·0046. Filtered January 2nd, 1911: specific gravity 1·034. Specific gravity in bottle, April 27th, 1911: 1·027. A sweet, thin bitter cider; flavour and aroma moderate. Too bitter alone; fair for blending.

Newton Red Jersey (Devon).—Analysis of fresh juice, October 27th, 1910: specific gravity 1·058, malic acid ·36 per cent., tannin ·450 per cent. Weight of fruit, 665lbs.; yield of juice, 535lbs. Average daily fall in specific gravity at 28°C., ·0035. Filtered December 5th, 1910: specific gravity 1·034. Specific gravity in bottle, April 27th, 1911: 1·032. A rich, sweet, full-

bodied cider of excellent quality; flavour pleasant with marked astringency, aroma good. Too bitter alone; excellent for blending.

Norton Bitter (Somerset).—Analysis of fresh juice, November 24th, 1910: specific gravity 1·061, malic acid ·33 per cent., tannin ·364 per cent. Weight of fruit, 769lbs.; yield of juice, 543lbs. Average daily fall in specific gravity at 28°C., ·0051. Filtered December 28th, 1910: specific gravity 1·034. Specific gravity in bottle, April 27th, 1911: 1·030. A pleasant, sweet, full bodied cider of rather bitter character; aroma and flavour very fair, but inclined to be coarse. Very useful for blending.

Red Jersey (Somerset).—Analysis of fresh juice, November 10th, 1910: specific gravity 1·060, malic acid ·26 per cent., tannin ·498 per cent. Weight of fruit, 1,088lbs.; yield of juice, 840lbs. Average daily fall in specific gravity at 28°C., ·0049. Filtered December 19th, 1910: specific gravity 1·030. Specific gravity in bottle, April 27th, 1911: 1·024. A medium sweet cider of coarse bitter type; aroma and flavour inferior. The tannin is too pronounced for use alone, and stands out very prominently in blends. Can only be utilised satisfactorily in small quantities.

Royal Jersey (Somerset).—Analysis of fresh juice, October 31st, 1910: specific gravity 1·058, malic acid ·20 per cent., tannin ·440 per cent. Weight of fruit, 1,029lbs.; yield of juice, 789lbs. Average daily fall in specific gravity at 28°C., ·0029. Filtered December 19th, 1910: specific gravity 1·036. Specific gravity in bottle, April 27th, 1911: 1·035. A rich sweet cider of superior bittersweet type; flavour and aroma excellent. Slightly too astringent alone; valuable for blending.

Strawberry Norman (Hereford).—Analysis of fresh juice, December 6th, 1911: specific gravity 1·053, malic acid ·27 per cent., tannin ·436 per cent. Weight of fruit, 1,004lbs.; yield of juice, 752lbs. Average daily fall in specific gravity at 28°C., ·0046. Filtered December 28th, 1910: specific gravity 1·034. Specific gravity in bottle, April 27th, 1911: 1·029. A sweet, somewhat astringent cider of good quality; aroma and flavour pleasant. Rather too bitter unblended.

Upright French (Hereford).—Analysis of fresh juice, December 6th, 1910: specific gravity 1·052, malic acid ·30 per cent., tannin ·460 per cent. Weight of fruit, 2,515lbs.; yield of juice, 1,958lbs. Average daily fall in specific gravity at 28°C., ·0095. Filtered January 9th, 1911: specific gravity 1·003. Specific gravity in bottle, April 27th, 1911: 1·003. A coarse, bitter, dry cider of inferior aroma and flavour. Can be utilised for a dry blend, but the coarseness is too strongly marked for satisfactory results.

PERRY.

Coppy (Worcester).—Analysis of fresh juice, October 21st, 1910: specific gravity 1·047, malic acid ·29 per cent., tannin ·050 per cent. Weight of fruit, 1,263lbs.; yield of juice, 1,013lbs. Average daily fall in specific gravity at 28°C., ·0031. Filtered November 7th, 1910: specific gravity 1·039. Specific gravity in bottle, April 27th, 1911: 1·029. A sweet, thin, and somewhat insipid perry; flavour characteristic and moderate, aroma fair. Fairly useful for blending with brisker and more astringent types, but lacking in character alone.

New Meadow (Hereford).—Analysis of fresh juice, November 7th, 1910: specific gravity 1·049, malic acid ·27 per cent., tannin ·026 per cent. Weight of fruit, 1,017lbs.; yield of juice, 814lbs. Average daily fall in specific gravity at 28°C., ·0031. Filtered November 28th, 1910: specific gravity 1·033.

Specific gravity in bottle, April 27th, 1911 : 1·024. A medium sweet, thin perry of fair quality ; flavour fair but insipid, aroma fair. Too characterless for use alone, but well adapted for blending. Might yield a good dry perry.

Paxford (Worcester).—Analysis of fresh juice, October 11th, 1910 : specific gravity 1.054, malic acid ·65 per cent., tannin ·110 per cent. Weight of fruit, 5401bs. ; yield of juice, 4071bs. Average daily fall in specific gravity at 28°C., ·0086. Filtered November 7th, 1910 : specific gravity 1·023. Specific gravity in bottle, April 27th, 1911 : 1·017. A brisk, semi-dry perry, of rather coarse type ; body, flavour, and aroma fair, but crude and somewhat harsh. Lacks quality for use alone, but fairly useful for blending.

Red Horse (Worcester).—Analysis of fresh juice, October 21st, 1910 : specific gravity 1·051, malic acid ·51 per cent., tannin ·088 per cent. Weight of fruit, 8731b. ; yield of juice, 6731bs. Average daily fall in specific gravity at 28°C., ·0025. Filtered November 7th, 1910 : specific gravity, 1·040. Specific gravity in bottle, April 27th, 1911 : 1·037. A sweet, medium brisk perry of pleasant flavour and aroma ; body fairly full. In the early part of the summer very good unblended, deteriorating somewhat later in the year ; useful for blending.

Rock (Hereford).—Analysis of fresh juice, December 6th, 1910 : specific gravity 1·070, malic acid ·41 per cent., tannin ·480 per cent. Weight of fruit, 1,0441bs. ; yield of juice, 7801bs. Average daily fall in specific gravity at 28°C., ·0030. Unfiltered, the liquor clearing itself quickly by the formation of a dense, jelly-like clot of pectic material. Specific gravity in bottle, April 27th, 1911 : 1·051. A rich, sweet, full-bodied perry ; flavour marred by excessive astringency, otherwise excellent, aroma good. Almost undrinkable alone, and difficult to use for blending owing to the production of dense milky turbidity after admixture with other kinds.

Yellow Huffcap (Hereford).—Analysis of fresh juice, November 5th, 1910 : specific gravity 1·056, malic acid ·40 per cent., tannin ·080 per cent. Weight of fruit, 1,1471bs. ; yield of juice, 9331bs. Average daily fall in specific gravity at 28°C., ·0092. Filtered November 28th, 1910 : specific gravity 1·037. Specific gravity in bottle, April 27th, 1911 : 1·012. A thin, medium dry perry of unpleasant flavour and aroma. Inferior for blending and unsuited for use alone. Improved considerably towards the end of the summer.

As was anticipated, the effect of the character of the weather during the summer and autumn of 1910 on the nature of the cider and perry was very marked. For the most part the juices were below the average in respect of sugar, although this feature was not so marked as might have been expected. The rate of fermentation, although, perhaps, rather higher than usual, was not unduly rapid, especially if the lack of sunshine during the summer of that year is taken into consideration. The figures for tannin were rather variable, but not, as a rule, very different from the average. The effect of this substance on the flavour of the cider was, however, much more pronounced than usual, the deficiencies of the ciders in other respects allowing the astringency of the tannin to stand out prominently. This feature and an acidity higher than the normal, as well as a general thinness and lack of body, constitute the principal characteristics of the 1910 vintage.

THE EXPERIMENTAL ERROR IN CIDER-MAKING INVESTIGATIONS.

It is generally recognised that experiments of an agricultural character cannot as a rule furnish results of that close degree of accuracy which can be attained from experiments dealing with any of the more exact sciences. This is due primarily to the fact that the agricultural investigator is not able to exercise the same degree of control over the conditions of his experiments as, for example, the chemist or the physicist. Factors, such for example as the soil and the weather, are so variable and at the same time exert so much influence upon the results of the experiments that, although two identical series of experiments might be carried out under apparently exactly similar conditions, it is inevitable that the results will vary somewhat, and that they will not, as a rule, do more than approximately correspond.

In carrying on agricultural research it is, therefore, obviously necessary, firstly, that the limits of variation in the results of the same experiments carried out repeatedly under conditions as much alike as is practicable should be ascertained as nearly as possible in order that a distinction may be drawn between such unavoidable differences and those which may be due to differences in treatment as a part of the experiment; and, secondly, that in any set of experiments precautions should be taken and methods arranged to reduce the unavoidable differences to a minimum, so that results due to the form of treatment in the experiments themselves may have every chance to be distinguished from those due to the former cause, or experimental error, as it is termed. It is evident that if in any set of experiments the results under one form of treatment do not differ from those under another form by more than the margin of experimental error, it is impossible to decide whether the difference observed is due to the form of treatment or merely to the unavoidable irregularities which may occur when the form of treatment is the same. Some idea of the probable extent of the experimental error is requisite, therefore, before the results can be estimated at their true value. The extent of the error is naturally much greater in some kinds of experiments than in others, and is dependent very largely upon the nature of the experiment.

Experiments in connection with cider-making lend themselves in a very marked degree to such errors; and for a time it was difficult to know what degree of importance to attach to the results. The work carried on in the cider house at the Institute for the past seven years has proved to be especially useful in illustrating the

possible effect of many of the most important sources of error and in indicating the means of reducing the error.

It is not intended here to enter into a detailed discussion of all the likely sources of error connected with experiments in cider-making and their magnitude; but since every maker who is anxious to improve the quality of his cider must experiment, even if only to a very limited degree, it may prove of service and assist him to a true interpretation of his results if a summary of some of the results at the Institute is given as an illustration of the unreliability of individual trials.

The first subject which may be referred to is that of cider fruit. One of the main objects of experiment in connection with it is to find its vintage value with a view of distinguishing the superior varieties from those of inferior quality. The pitfalls are numerous and may lead to serious error. It is, of course, essential that each variety should be treated separately, any mixture with other kinds rendering the results of no value. Experiments at the Institute have proved that any one of the following factors—the nature of the soil upon which the fruit was grown, the character of the season, the state of ripeness of the fruit at the time of milling, the condition of the fruit as regards cleanliness and freedom from decay and rot,—is capable of causing a result which is entirely misleading as a record of the normal quality of the variety under trial. As an example the results of the past seven years' trials of the Kingston Black variety may be quoted. During that period more than thirty samples of that apple have been made into cider in bulk in the cider house, and 100 additional samples have been dealt with on a small scale in the laboratory. The variation in the quality and character of the ciders produced has been remarkable. The normal type of cider produced by Kingston Black is, as is well known, a medium brisk cider of good body with characteristic flavour and aroma, the juice fermenting slowly and the fermentation being capable of regulation so as to give almost any degree of sweetness desired. In the results referred to, the cider has occasionally been so lacking in briskness that it might almost have been judged to have been produced from an apple of the sweet class,—in one or two instances the bitterness has been so marked as to suggest that the variety belonged to the bitter-sweet type,—at other times the acidity has been so pronounced that the result was comparable to that from a very sharp apple, such as Cap of Liberty. Instead of the cider being invariably full-bodied, in one or two cases it was almost as thin as that of a Morgan Sweet cider. While, generally, it possessed the

typical Kingston Black aroma and flavour, in some instances these were altogether lacking, and an expert would have found it impossible to recognise it as Kingston Black. Typical Kingston Black juices ferment so slowly and regularly that there is generally no difficulty in arresting fermentation at any desired point, and in thus retaining any required degree of natural sweetness. A few of the juices dealt with, however, fermented excessively rapidly, and it was difficult, even by repeated filtration, to restrain fermentation enough to retain much natural sweetness.

While it is only fair to state that these results represent extreme cases, and that they were obtained, not from fruit from the same orchard year after year, nor from samples from different districts in the same season, but from separate orchards on distinct types of soil and in different seasons which varied greatly as regards their influence upon the character of the vintage; yet assuming that it had been possible to get samples in sufficient quantity each season from the same trees, there is no doubt that variations of a similar character, though, perhaps, not quite so marked, would have been recorded. To prove this contention, reference may be made to the results of the series of analyses of the Dabinett apples from a number of trees in the Institute orchard. These have been given each year since the trees began to bear in the Annual Reports of the Institute. The trees grow in the same row in the orchard, the soil varies comparatively little, and the conditions are apparently practically the same throughout. Nevertheless in any one season—to say nothing of the comparative results for different seasons—marked differences in the quality of individual juices occur, which in some years are sufficiently wide to be comparable with those just referred to in the case of the Kingston Black ciders.

In the face of this diversity it is obvious that it is not a simple matter to decide what is the vintage character and value of any variety. Clearly the result of a single trial may be absolutely misleading. The most reliable way to arrive at a satisfactory decision is to obtain a sufficiently large number of results of individual trials made under a variety of conditions, so that it can be conclusively seen what type of result may be considered representative of the variety. Referring back to the Kingston Black example, the typical character of the cider made from this variety is now so well known that there is no difficulty in deciding whether any individual sample of Kingston Black cider is representative of the vintage qualities of that variety, or whether it is misleading. This is owing to the fact that the trials of this variety have been

sufficiently numerous to make it perfectly clear what a Kingston Black cider under fair conditions should be.

However, it is manifestly impossible for even a small proportion of the existing cider varieties to be thoroughly tested in that fashion. The amount of time and labour required would prohibit it. Either one would have to be content with the results of a limited number of trials,—taking the chances of the results being somewhere near the truth and corresponding reasonably closely with one another,—or a few sorts only could be tested. It is here that the work with the Kingston Black ciders is of assistance. It shows clearly under what conditions the results approach the typical, and in what circumstances anomalous results may be expected, thereby furnishing a guide for work with other varieties. Using the results of that work as a basis for a standard method of testing, the following outline may be taken as the minimum from which definite reliable conclusions could be drawn.

For any variety not less than three trials should be made, and these must be made in at least three separate seasons. The seasons selected for the purpose should be fairly normal in character. It would be useless to expect reliable results from trials with fruit pressed, for example, in the autumns of 1910 or 1911, owing in the former case to the cold, wet, sunless summer, and in the latter to the heat and long-continued drought. The soil on which the fruit is grown should be of a type known to be capable of producing good cider from standard varieties. A test with fruit grown on a light sandy soil, known to be incapable of producing anything but a thin hard cider, would obviously possess no value as a trial of the merits of the variety. The fruit should be taken from healthy trees in their prime, since the results with fruit from young or very old trees are frequently far from typical. The sample of fruit must be a fair one, free from excessively bruised or decaying apples. It should not be gathered until perfectly fit to come from the trees, and it should then be stored, preferably with protection against the weather, until it reaches the right stage of ripeness for milling. Unreliable results will be obtained if the apples are milled in an unripe or over-ripe condition. The methods of cider-making followed must be the same on each occasion, and approximately the same bulk of juice should be used for each trial. Finally, if any accidental taint of flavour should be acquired, or any circumstance arise which indicates that influences likely to affect the result have been at work, the trial should be rejected absolutely, or its results accepted only with reserve corresponding to the degree of seriousness of the disturbing factor. If, after these precautions have been taken,

the results for the respective trials correspond fairly well, they may be accepted with confidence as reasonably accurate. If, on the other hand, the results are seriously discordant, no final decision is justified until after further trial.

If, instead of testing the quality of the fruit, it is desired to compare the effect of certain variations in the method of making, corresponding precautions to ensure the reliability of the results are necessary. These differ according to the nature of the matter under investigation. There is also introduced the element of comparison. To take a concrete example, the question of the relative merits of immediate pressing of the pomace and maceration for some hours before pressing may be considered. In this case the kind of fruit used in the experiments is not of primary importance ; but it is necessary that for each test either the same kind of fruit should be used, or, if more than one variety is utilised, the proportionate weights of each kind in the mixture should be the same. The fruit in each instance should be taken from the same source. The milling of the fruit should be done on the same day, in the same manner, and under the same conditions. The pressing of the pomace should be regulated so as to be as nearly as possible uniform for both lots of pomace. The quantity of juice eventually utilised should be the same in both cases, and the fermentation should be carried out in casks of equal size and of the same type. The after-treatment of the juice must be identical in each case, and if racking and filtration are resorted to, those operations must be performed for both lots of cider on the same day. It is highly desirable that immediately after filtration samples of each should be bottled off, since the cider in bottle is more likely to afford a reliable basis of comparison than that in cask on account of the risk of deterioration from outside influences in the latter case. In deciding the relative merits of the two systems a number of individual points of comparison must be taken into account, such, for example, as the yield of juice, its rate of fermentation, the ease of filtration, the degree of natural clearing, the aroma, flavour, and body of the mature cider, and its keeping qualities.

Unfortunately in working on a practical scale each of those points is liable to be affected by external agencies to so serious an extent that the effects caused in this way may be at least as great as any produced by the difference in treatment in the two cases. It has not, for example, been possible hitherto to regulate the pressure during the expression of the juice so that the two cheeses may be subjected to exactly the same power for the same space of time. Consequently, unless the general tendency as regards yield of juice

in a long series of results is in the same direction, no reliable conclusion on that point can be arrived at. Again, as regards rate of fermentation, this depends not only upon the kinds of yeasts present in the two cases and their relative proportion—a matter which it is very difficult, if not impossible, to control satisfactorily—but also upon the cask in which the juice is fermented. Casks of apparently the same type in every respect frequently differ widely in their influence upon the rate of fermentation of the contained juices. Possibly to some extent the difficulties as regards rate of fermentation may be eventually overcome at the Institute by the use of equal amounts of a selected yeast added in quantities sufficient to dominate fermentation, and by the substitution of glazed vessels for casks. The latter cannot be thoroughly sterilised with certainty, and the aeration of the juice also varies. Those drawbacks would be obviated by the use of glazed vessels. With regard to the other points mentioned there are also difficulties of corresponding importance which need not be enumerated here. It has been shown sufficiently that in any single experiment the chances of obtaining a reliable result, even with the most careful work, are seriously affected by the numerous factors which can interfere.

In order, therefore, for any conclusions to be satisfactory they must be based upon the results of a comparatively large number of individual experiments. It is unlikely that the results will in all cases be strictly uniform. They have proved in many instances to be very discordant. The most careful discretion is thus necessary in drawing conclusions, and real progress can only be obtained after careful and long-continued investigation.

The Relations Between the Tree and its Treatment and the Vintage Quality of its Fruit.

Some attention has been paid to this subject in the last four Annual Reports, in which statistics of the quality of the juices from individual trees grown under different conditions in the plantations and orchards at the Institute have been given each season the trees have produced fruit. If the character of the tree or its method of treatment has any marked influence upon the vintage quality of the juice, the question is obviously of great importance to the cider-maker, since it opens up a field of wide possibilities for the improvement of cider. The matter requires investigation in several directions and the necessary experiments are being started at the Institute as opportunity arises. Conclusive results must inevitably take long

to attain, since in the first place several seasons are required for the trees to come into bearing, and secondly, the effect of the season on the quality of the juice is so considerable that it is necessary to obtain the results for several years in order that seasonal influence may be eliminated.

The experiments with trees planted in the early years of the Institute have furnished results each season since 1908 in some instances, so that the records for four seasons are now available, and it is possible to gain some idea of the direction in which they are shaping. The experiments with the Dabinett variety head-grafted upon different intermediate stocks are the most advanced. The figures for 1911 are given in Table A (see p. 35), which also includes the *average* results for the three previous years. It has been deemed unnecessary to repeat in detail individual results for each of those years, since they were given in last year's Report, and would therefore only add to the mass of statistics with which this Report is already overburdened. Table B (see p. 36) gives the analyses of the juices from the Young Orchard trees, which have been under various forms of treatment to ascertain the effect of grass upon their growth and other functions. Three years' figures are in this case available, those for 1911 and the *average* results for 1909-11 being tabulated separately. In Table C (see p. 41) are given the first results of a series of experiments on the influence of the kind of root-stock upon which the varieties tested have been worked. Most of the trees in this series which cropped in 1911 were worked on the Paradise rootstock, and in the majority of cases an intermediate stock had been previously worked to give a more exhaustive trial of the intermediate stock experiments with the Dabinett variety referred to above.

The results in the respective series of experiments will be considered separately.

The Influence of the Intermediate Stock.

The trees which have furnished the results recorded in Table A are, with the exceptions undermentioned, planted in a single row in the Young Orchard at the Institute. They were planted in January, 1904, and were head-grafted with the Dabinett variety in April, 1906. The exceptions referred to are Annie Elizabeth No. 1, Morgan Sweet Nos. 1–5, and Newton Wonder Nos. 1–3. These are situated in an open space in the Old Orchard, where the original trees died and were removed some years ago. The Old Orchard adjoins the Young Orchard, and the rows of

trees in the two cases are not more than 30 yards apart. The soil is substantially similar in both instances, and varies comparatively little in general character throughout the two rows. The treatment of the trees has been identical throughout; and the only obvious difference between the two sets is that the former were planted in new ground while the latter occupy a site on which apple trees had previously been grown.

Reviewing first the 1911 analyses, it will be observed that the individual results, as in previous years, vary greatly for all the characters dealt with. The specific gravity ranges from 1·086 to 1·064, the percentage of malic acid from ·33 to ·13, the percentage of tannin from ·792 to ·380, and the rate of fermentation from 9·9 to 3·0. In several instances there are two or more trees where the same intermediate stock has been used: and in such cases there is a want of unanimity in the results of the duplicate trees, just as was the case in previous years. Hitherto, however, the trees in which the Morgan Sweet variety has been used as the intermediate stock differed in this respect from the general rule, the results generally approximating closely as compared with the divergence in the other instances. This season they fall into line with the other varieties in the matter of irregularity.

The results, as a whole, when compared with those from the same trees in previous seasons, are remarkable on account of the striking increase in the specific gravity and the percentage of tannin and the marked reduction in the rate of fermentation. These features undoubtedly ought to be attributed mainly to the character of the 1911 season. The acidity on the other hand, although showing considerable variation in individual cases and a tendency in the majority to be decidedly high when the general conditions are taken into account, nevertheless does not average much above the combined average of preceding years. A comparison has been made between the analyses of the juices from individual trees and the relative amounts of growth made by those trees during the year, but no correlation has been detected. The same statement holds good also for the average composition of the juices for all the years when they have fruited and the total amount of growth made by the respective trees since planting.

Turning now to the average results from individual trees for the years 1908–11, a striking difference in their general character is to be noted. When compared with the marked variations in individual results which have been so noticeable when any single year's records have been examined, the close approximation in practically every

case to the general average for all the trees is remarkable, especially when the comparatively unsatisfactory and inadequate methods of examination of the quality of the fruit are taken into consideration. Detailed examination of the records season by season and of the averages for individual trees shows that with each successive season the general levelling up of the averages tends to become more pronounced. Thus, for example, a tree which has given in one year a specific gravity which is exceptionally high for the season has generally given gravities below the average for preceding or subsequent years, and has thus over a period of years reduced itself to the approximate level of other trees. It is the same with all the other characters examined, except the rate of fermentation in the few instances to which attention is now drawn. These cases are the trees situate in the Old Orchard for which Annie Elizabeth, Morgan Sweet, and Newton Wonder have been used as intermediate stocks. The average rates of fermentation in these instances fall decidedly below the average for the whole of the trees, and also for the trees in the Young Orchard for which similar intermediate stocks have been utilised. The most striking examples are furnished by the Morgan Sweets, Nos. 1–5 of which are in the Old Orchard and have shown average rates of fermentation ranging between 5·5 and 9·0, while the corresponding tree (No. 6) in the Young Orchard has given an average rate of 13·5. These results can hardly be dismissed as chance, and must apparently be taken to indicate that the site has been the responsible factor. The explanation which naturally suggests itself is that the Old Orchard site has previously borne a crop of apple trees, which has affected the soil in such a way that the constitution of the recently planted trees has been in some manner impaired. This effect, resulting probably in the presence of less nitrogenous material in the juice of the fruit, has thereby produced the slower rate of fermentation. It has been shown in previous Reports that the rate of fermentation is primarily determined by the amount of nitrogenous constituents in the juice, and that the rate tends to be the higher the more vigorous the constitution of the tree.

It is impossible to ignore the conclusion so plainly indicated by the results of the past four seasons' crops that the individual trees in the experiment tend to give the same average result, if spread over a sufficiently long period of years, in spite of the difference in the character of the intermediate stocks used. Accordingly it must be concluded that, as far as present evidence goes, the intermediate stock as used in the manner under consideration has apparently little direct or demonstrable influence upon the vintage quality of the fruit of the variety worked upon it. Stock influence on the quality

of the juice, however, under certain conditions may be appreciable, as indicated in succeeding paragraphs of this section; while its possible effect upon the general vegetative character of the tree must not be overlooked.

These results are not only of value in respect of the intermediate stock question. They serve also to create a certain confidence that in a trial of the vintage qualities of any variety on a given soil reliable results may be obtained from a very limited number of trees without the necessity of being fully acquainted with details as to the history of the tree and the stock upon which the variety is worked, provided that records of the results are taken and averaged over a period of years.

While it may now be regarded, in the light of these results, as extremely probable that the tendency of individual trees of the same variety in an orchard is to give results which approximate very closely when averaged over a period of years, the striking differences between tree and tree for any single year still remain to be accounted for. It is believed after a detailed examination of the records of each tree for the past four seasons that an explanation has been found.

The facts which have led to this conclusion are not derived exclusively from the Dabinett results. Taking all the varieties grown in the Young Orchard, the same phenomena as those about to be indicated have been observed; and reference to Table B for the records of any single variety will show how general those features are, in spite of the fact that the treatment of individual trees has differed considerably.

It has been repeatedly noticed, when making the analyses of any single variety each year, that the results for consecutive trees in the same row did not vary irregularly, but showed a general tendency to rise or fall in wave-like fashion along the row. The following table, which contains the results of the Dabinett trees for 1911 already given in Table A, but here tabulated in the order of the trees in the row through the orchard instead of being arranged in alphabetical order according to the kind of intermediate stock, indicates very well the features to which it is desired to draw attention. The tannin figures are not included, since they do not in this particular case afford a very striking example, although to a lesser degree they exhibit the same general tendency as the specific gravity, acidity, and rate of fermentation figures. That the tannin results follow the same type of variation as those for the other characters can be well seen in the Chisel Jersey and Sweet Alford statistics in Table B.

Order of Tree in Row.	Specific Gravity.	Malic Acid per cent.	Rate of Fermentation.
1. (Morgan Sweet) ..	1·065	·15	3·6
2. (Broadleaf Jersey) ..	1·077	·13	6·9
3. (King of the Pippins) ..	1·064	·19	7·4
4. (Hardwicke)	1·086	·20	9·9
5. (Warner's King	1·078	·20	6·0
6. (Bramley's Seedling) ..	1·076	·18	3·9
7. (Ecklinville)	1·074	·17	5·2
8. (Blenheim Orange) ..	1·068	·15	3·5
9. (Annie Elizabeth) ..	1·074	·19	3·7
10. (Newton Wonder) ..	1·068	·16	4·6
11. (Peasgood Nonsuch) ..	1·064	·23	6·1
12. (Hollow Core)	1·067	·29	4·6
13. (Sweet Alford)	1·066	·27	5·5
14. (Broadleaf Norman) ..	1·065	·28	3·9
15. (Court Royal)	1·074	·29	3·7
16. (Ecklinville)	1·074	·33	3·4
17. (Bramley's Seedling) ..	1·074	·28	5·5
18. (Blenheim Orange) ..	1·066	·24	4·7

Dealing first with the specific gravity records it will be seen that they can be divided into three main groups. The first begins with Tree No. 2 and continues to Tree No. 9, the gravities ranging, with the exceptions of Nos. 3 and 8, between 1·074 and 1·086, No. 4 marking the highest point and a steady decrease being shown from No. 5 onwards. This decrease is continued into the second group, which comprises Nos. 10–14 inclusive, the lowest point, 1·064, being reached at No. 11. In this group the gravities range between 1·068 and 1·064. The third group, a small one, begins suddenly at No. 15 and continues to No. 17, the gravity being 1·074 in each instance. Nos. 1 and 18, the extreme points of the row, appear to mark the beginnings of new groups.

The records of acidity are even more definite than those of specific gravity. Two well defined groups exist, the first—in which the acidity rules low, with a tendency to rise between No. 3 and No. 6—including Nos. 1—10, and the second—in which the acidity is decidedly higher—ranging from No. 11 to No. 18.

The rate of fermentation column shows a gradual rise from No. 1 to No. 4, followed by a fall to the 3·4—3·9 level, which is then maintained fairly evenly with slight rises from No. 9 to No. 13, and at Nos. 17 and 18.

It looks, therefore, as if there were certain differences in the local conditions in the orchard which caused these groups, since it cannot be mere coincidence that the high and low results are associated in

that fashion. An isolated instance of grouping might be attributed to coincidence ; but in view of similar phenomena occurring throughout the orchard with other varieties also, not only in respect of specific gravity, but of acidity, tannin content, and rate of fermentation, and in the results for previous seasons as well as for 1911, it seems imperative to discard all idea of chance association. On account of the trees in the Dabinett row having been throughout under identical treatment, and, being alike in character except as regards the nature of the intermediate stock and the usual root-stock variations due to the use of the free stock—which features have not yet proved of sufficient influence to have a demonstrable effect on the results—it follows that the phenomena under consideration must be attributed to the influence of external conditions on the trees.

The most likely source to provide an explanation is the soil, since the above ground conditions for all the trees are apparently practically identical. There is very little obvious variation in the general character of the soil, but comparatively slight local differences may possibly be sufficient to account for the results. To settle that point a detailed examination of the soil around each tree will be necessary. It is intended to make this at the earliest opportunity. Exceptional cases, such as Nos. 3 and 8 in the specific gravity records quoted above, are easily capable of explanation, if the hypothesis of soil variation is correct.

That the effect is caused by variations in the chemical composition of the soil is probably not so likely as that it is brought about by physical differences. If the chemical explanation were correct, it would be expected that the areas would remain much the same from year to year, whereas in fact they do not coincide. The physical effect is more feasible, since it has already been shown in the Report for 1909 that there is considerable reason for believing that it exerts decided influence upon the quality of vintage fruit. It also renders more easy of explanation the shifting of the areas from season to season, since their condition as regards moisture content and corresponding features naturally varies according to the character of the season. The question needs further investigation before a final explanation can be given ; but in any case it is evident that we have to deal with an influence which is sufficient to more than outweigh any due to the treatment or character of the trees in the series of experiments in progress in the Young Orchard.

The Influence of Grass.

The majority of the trees in the Young Orchard have been included in a series of experiments carried on to determine

what influence upon the growth of the tree and upon the vintage quality of the juice is exerted by grass being allowed to grow around the tree. The orchard was previously a meadow. For the first year after planting (1904), the grass was removed around each tree for a radius of 3 feet. Afterwards in certain cases it was allowed to grow right up to the tree, in other instances the cleared cultivated circle of 3 feet radius was maintained, and in the remainder this circle was extended to a radius of 4 feet 6 inches. In 1909 the cultivated circle around a few trees treated in the latter fashion was increased to a radius of 6 feet. In the spring of 1911 the cultivation was discontinued, and grass has now been allowed to grow around all the trees.

It has been shown in previous Reports that the removal of the grass exerted a beneficial influence upon the growth of the tree, although the results have not apparently been so marked as those in the Woburn experiments. As regards the influence of the grassing upon the vintage quality of the fruit it has not been possible hitherto to draw conclusions. Each season the trees have borne fruit the results of the analyses have been included in these Reports, but they have generally proved so irregular and divergent in character that it has not been practicable to base any generalisations upon them. In many instances the trees have not begun to crop regularly yet, and analytical details for three or four consecutive years are only available in a limited number of cases. It would have been premature to have attached much importance to individual results up to date, if it had not been for the general tendency to follow on similar lines those from the Dabinett trees which have already been discussed. As it is, the resemblance is somewhat striking and merits attention. Table B contains the analytical records of individual trees for the year 1911 and also the averages for the years 1909–11, where the trees have produced sufficient fruit for analysis in each of those seasons.

After the above discussion of the Dabinett results there is no occasion to review these also in detail nor to do more than indicate the points of resemblance. It will be noticed that the method of treatment of the tree as regards grassing has no demonstrable influence upon the analytical results. This holds good for the 1911 records and also for the averages of 1909–11. The irregularity of the results of duplicate trees of the same variety is marked for 1911 as well as for previous seasons. There is, as with the Dabinetts, a tendency for the average results of individual trees of the same variety to approximate closely, however widely the single records for this or for previous seasons may have differed.

There is also, both in the 1911 results and those of previous seasons, the same tendency for both the gravity, acidity, tannin, and rate of fermentation records to rise and fall in wave-like manner along the rows from tree to tree.

Under these circumstances there is nothing which need be added to what has already been stated in connection with the Dabinett records. Possibly when further records for a longer period of years have been acquired, additional light may be thrown upon the subject.

Rootstock and Allied Influences.

There is no question that the character of the rootstock has a very considerable and, at present, very little understood influence upon the character of the tree. Every fruit-grower is, for instance, familiar with the differences brought about by working the same variety on the Paradise and on the crab or tree stock, the former in some manner being able to dwarf the growth and to throw the tree into early bearing. From the histories of the various types of Paradise stock it seems clear that there is no essential difference in nature between them and the ordinary crab or free stock, the only real distinction being that the former have to a large extent replaced the typical tap-root habit of the root-system of the crab by one of a more fibrous and superficial character. While probably the true crab type of rooting is fairly constant, it is incontestable that among free stocks there are comparatively wide variations, the majority more or less closely resembling the crab type with an occasional example approximating to the Paradise habit. Since the majority of standard apple trees are worked on free stocks, it is important to learn as much as possible about the influence of the character of the root-system upon the tree as a whole. If it is fair to judge from the two extreme cases of the Paradise and the crab rootstocks, some influence upon the longevity of the tree, its cropping qualities, and the character and quality of the fruit may certainly be anticipated. The interest of the cider-maker will naturally be mainly centred upon the latter features, since they directly affect the quality of the cider ; but all sides of the question are important to the cider fruit-grower, and the whole matter is one which may have considerable bearing upon fruit-growing generally. On that account a brief description of the experiments in this connection now in progress at the Institute may be of interest, although the work is still in its early stages, so that but few results are yet available and definite conclusions cannot be expected for some years to come.

The original experiments were started in the summer of 1904, when a large number of Paradise stocks in the nursery at the Institute were budded with the vintage varieties already planted in the form of standard trees on the free stock in the Young Orchard the previous winter. The latter trees are thus in most cases five years older than those on the Paradise stock. In due course the Paradise trees were trained in bush form and planted out in a plot of cultivated land, which has since been kept cultivated, differing in this respect from the Young Orchard, which is grass land. This plantation is being treated in the same way as an ordinary cultivated market fruit plantation comprised of bush apples on the Paradise stock, and it will thus constitute a test of this system for the culture of vintage fruit in addition to its place in the rootstock experiment scheme. The soil in this plantation is rather different in character from that of the Young Orchard. It will thus unfortunately not be possible to attribute the results entirely to rootstock influence, there being, as already indicated, some differences in the soils, the age and character of the trees, and the cultivation of the land between the trees in this plantation and those in the Young Orchard.

These experiments have, therefore, been supplemented and extended recently in the following manner. A selection of ten stocks, all of which show to some extent, although to a variable degree, the superficial fibrous habit of root-system typical of Paradise stocks, was made from a batch of free stocks planted a few years ago in the Nursery. From these ten distinct forms of parent stocks a number of daughter stocks have been propagated by layering and have been grafted with a selection of vintage and market varieties which it is desired to test. We have thus the same varieties worked on ten different types of rootstock, all of which have been directly obtained from the ten original parents. The age of these trees is the same, their treatment has been and will continue to be identical, and they will in due course be planted out in a special plantation, the evil of which will be as even in character as can be found. These trees should afford an excellent test of rootstock influence.

In addition to these selected rootstocks belonging to the group of free stocks, an attempt is being made, by layering in a similar fashion, to raise a batch of stocks from bushes of Cox's Orange Pippin, Bramley's Seedling, and a few other well-known market varieties which show marked differences in vigour of growth and cropping and other qualities. On these also will be worked the varieties it is intended to test, and the trees will afterwards be treated like those on the selected free stocks just referred to.

Since there happened in several instances to be a fair number of the bush trees on the Paradise stock already referred to available, it was decided to utilise some for the purpose of testing more thoroughly the intermediate stock question. Accordingly several have been re-grafted with the Dabinett, Cap of Liberty, Kingston Black, and a few other well-known vintage sorts. In connection with the Dabinett intermediate stock experiments described in an earlier section of this Report the method by which the intermediate stock can exert influence upon the variety with which it has been grafted is clearly restricted. The only part of the tree into which the intermediate stock enters is the stem. The main functions of the stem are to conduct the raw food materials absorbed by the roots to the leaves, which constitute the laboratory of the plant, and to transfer in the opposite direction the more complicated organic products manufactured in the leaves. Any part it may play in the chemistry of the tree is secondary only. Consequently it is to be expected that the kind of intermediate stock under consideration is only likely to exercise serious influence upon the grafted variety by serving as a regulator of the rate of interchange of products between root and leaf. It does not appear probable that it alters their nature or their relative proportions; and therefore its influence upon the vintage quality of the fruit can hardly be great, except, possibly, as affecting the concentration of the juice. If, on the other hand, the head of the intermediate stock is not entirely grafted with the selected variety and some branches are left unworked so that they may produce foliage belonging to the intermediate stock variety, there is a possibility that in those leaves the products characteristic of that variety may be elaborated and may in part eventually find their way to the fruit of the grafted variety and affect its composition.

In order to test this idea some of the bushes on the Paradise stock have not been completely re-grafted with the varieties mentioned above. In some instances every branch but one, and in others only a single branch has been grafted. As an extreme case more than one variety has been grafted on to the same bush, the varieties worked on each bush including representatives of the sharp, sweet, and bittersweet classes of apples.

Last season a few of the trees in these series of experiments fruited, and the results of the analyses of the juices are mostly given in Table C. A few of the results on the Paradise stock are included in Table B. Until records for a larger number of seasons are available, it will be premature to attempt to base definite conclusions upon them; but a few points seem worthy of notice. On the whole it will

be found that the rates of fermentation of the juices obtained from the trees worked on the Paradise stock are appreciably faster than those from standard trees of the corresponding variety on the free stock. The tendency noted in previous years' results for the tannin values to be low in the former case is not marked in the 1911 records. The most striking features of the statistics in Table C are, however, the great variations in the gravities and acidities of the Cap of Liberty juices. These were so wide that the flavour of the apples themselves taken direct from the trees was absolutely distinct in some instances, and, if it had not been for the appearance of the apples, no one would have suspected them to belong to the Cap of Liberty variety. The fruit from the tree in which White Jersey was used as the intermediate stock was the most extreme example. Since these trees possessed foliage of other varieties in addition to the Cap of Liberty foliage, being grafted in the manner explained above, it seems possible that the results may be accounted for by the influence of the other varieties ; but the weather of last summer was so abnormal that verification of these results in a more ordinary year is required before any such deduction is justified.

TABLE A. Composition of Dabinett Juices from Intermediate Stock Experiments.

Variety of Intermediate Stock.		Composition of Juice, 1911.				Average Composition of Juice, 1908-10.			
		Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.
Annie Elizabeth	Tree 1	1.072	.31	.580	3.7	1.061	.21	.188	10.1
Ditto	Tree 2	1.074	.19	.640	3.7	1·059	.21	.231	12.6
Blenheim Orange	Tree 1	1.068	.15	.584	3.5	1·057	.21	.293	11.1
Ditto	Tree 2	1.066	.24	.400	4.7	1.062	.18	.295	—
Bramley's Seedling	Tree 1	1.076	.18	.756	3.9	1.058	.18	.277	11.9
Ditto	Tree 2	1.074	.28	.508	5.5	1.059	.22	.237	11.3
Broadleaf Jersey	..	1.077	.13	.628	6.9	1.062	.17	.247	12.8
Broadleaf Norman	..	1.065	.28	.424	3.9	1.057	.24	.267	11.8
Court Royal ..	..	1.074	.29	.504	3.7	1.057	.21	.286	10.7
Ecklinville	Tree 1	1.074	.17	.580	5.2	1.059	.21	.243	12.6
Ditto	Tree 2	1.074	.33	.640	3.4	1.059	.20	.241	10.8
Hardwicke ..	..	1.086	.20	.792	9.9	1.057	.22	.230	12.3
Hollow Core ..	..	1.067	.29	.524	4.6	1.059	.22	.249	11.5
King of the Pippins	..	1.064	.19	.448	7.4	1.058	.21	.242	11.2
Morgan Sweet	Tree 1	1.070	.23	.636	3.1	1.058	.18	.267	5.5
Ditto	Tree 2	1.066	.29	.528	4.0	1.060	.19	.241	6.2
Ditto	Tree 3	1.071	.27	.508	4.9	1.060	.23	.245	6.8
Ditto	Tree 4	1.077	.25	.652	4.1	1.060	.19	.281	8.5
Ditto	Tree 5	1.082	.32	.664	4.2	1.058	.20	.243	9.0
Ditto	Tree 6	1.065	.15	.452	3.6	1.054	.21	.221	13.5
Newton Wonder ..	Tree 1	1.078	.29	.560	4.1	1.064	.19	.287	—
Ditto	Tree 2	1.076	.19	.552	3.0	1.057	.21	.263	—
Ditto	Tree 3	—	—	—	—	1.060	.20	.245	6.8
Ditto	Tree 4	1.068	.16	.528	4.6	1.055	.20	.212	11.8
Peasgood's Nonsuch	..	1.064	.23	.380	6.1	1.052	.22	.193	13.1
Sweet Alford ..	..	1.066	.27	.396	5.5	1.059	.24	.223	12.7
Warner's King	Tree 1	1.078	.20	.668	6.0	1.058	.19	.192	12.3
Ditto	Tree 2	—	—	—	—	1.065	.20	.305	11.7
Average ..	..	1.072	.23	.559	4.7	1.059	.20	.248	10.7

TABLE B.—Composition of Juices from Young Orchard Trees.

Name of Variety.	Number of Tree.	Composition of Juice, 1911.				Average Composition of Juice, 1909-11				Method of Treatment of Tree. (See footnote.)
		Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 Deg. C.	
Bédan des Partes (head-grafted on Broadleaf Jersey in 1906)	2	1·067	·20	·480	6·0	—	—	—	—	B.
	3	1·063	·19	·520	—	—	—	—	—	C.
Ditto	1	1·068	·32	·288	7·3	—	—	—	—	B.
Black Norman	2	1·077	·34	·344	10·3	1·059	·33	·251	—	C.
Ditto	3	1·068	·26	·332	—	—	—	—	—	D.
Ditto	1	1·057	·18	·172	5·0	1·053	·22	·163	8·4	B.
Broadleaf Norman	2	1·054	·20	·164	4·0	1·053	·23	·189	7·5	C.
Ditto	3	1·060	·18	·202	5·4	1·053	·22	·207	8·4	D.
Ditto	4	1·052	·17	·154	3·3	1·048	·22	·191	7·1	B.
Ditto	5	1·056	·17	·180	2·0	—	—	—	—	C.
Ditto	6	1·055	·15	·144	3·6	1·052	·21	·177	7·0	A.
Ditto	7	1·063	·19	·142	4·0	—	—	—	—	B.
Ditto	8	1·054	·14	·140	—	1·045	·17	·141	—	C.
Ditto	9	1·067	·11	·158	—	—	—	—	—	C.
Ditto	10	1·069	·13	·214	6·9	1·053	·18	·185	—	D.
Cap of Liberty (head-grafted on Morgan Sweet stock in 1906)	1	1·073	1·07	·286	6·4	—	—	—	—	B.
	2	1·083	1·03	·740	7·4	1·063	·93	·375	8·3	C.
Ditto	3	1·092	1·23	·628	7·7	1·066	1·26	·366	—	D.
Ditto	4	1·075	1·04	·396	5·6	—	—	—	—	B.
Ditto	5	1·072	1·03	·364	5·6	1·058	1·13	·281	7·1	C.
Ditto										
Ditto (head-grafted on King of Pippins stock in 1906)	2	1·064	1·00	·360	5·6	1·052	1·06	·279	—	C.
	3	1·064	·94	·284	7·4	1·054	1·02	·201	8·1	D.
Ditto	4	1·069	·98	·260	7·5	—	—	—	—	B.
Ditto										
Ditto (head-grafted on Broadleaf Jersey stock in 1906)	1	1·078	1·23	·360	8·4	—	—	—	—	B.

Cherry Norman	1	1·067	·12	·504	5·8	1·054	·16	·295	5·9	B.
Ditto	2	1·053	·10	·358	3·8	1·052	·15	·269	—	C.
Ditto	3	1·061	·15	·340	5·1	1·055	·18	·259	7·4	D.
Ditto	4	1·067	·15	·426	4·5	1·055	·20	·338	—	B.
Ditto	5	1·064	·16	·364	5·6	1·053	·21	·288	—	C.
Ditto	6	1·057	·12	·294	4·5	1·049	·16	·187	—	A.
Ditto	7	1·059	·12	·320	5·2	1·047	·19	·229	—	B.
Ditto	8	1·059	·15	·364	5·2	1·050	·17	·242	7·7	C.
Ditto	10	1·057	·15	·324	3·3	—	—	—	—	D.
Chisel Jersey	1	1·069	·21	·596	4·2	1·062	·27	·461	—	B.
Ditto	2	1·066	·14	·576	4·2	1·060	·24	·449	5·4	C.
Ditto	3	1·070	·18	·616	4·0	—	—	—	—	D.
Ditto	4	1·069	·27	·648	4·1	—	—	—	—	B.
Ditto	5	1·075	·29	·816	4·2	1·061	·28	·420	4·8	C.
Court Royal	2	1·057	·31	·162	10·2	1·050	·28	·129	—	C.
Ditto	3	1·052	·24	·210	—	1·051	·25	·149	—	D.
Ditto	4	1·067	·24	·192	7·4	1·057	·26	·154	—	B.
Cowarne Red	1	1·054	·70	·242	—	1·048	·67	·174	—	B.
Ditto	2	1·059	·68	·242	5·4	1·049	·67	·190	7·9	C.
Ditto	3	1·059	·65	·222	5·6	—	—	—	—	D.
Ditto	7	1·052	·58	·220	7·3	1·046	·59	·193	—	B.
Ditto	8	1·051	·58	·276	—	—	—	—	—	C.
Ditto	10	1·054	·66	·252	—	1·044	·63	·205	—	D.
Cremière (head-grafted on Morgan Sweet stock in 1905)		1·054	·22	·164	19·5	1·049	·25	·159	13·5	C.
Ditto (head-grafted on Warner's King stock in 1905)		1·050	·21	·096	—	1·045	·27	·143	—	B.
Ditto (grafted on Paradise stock)		1·050	·12	·080	25·0	—	—	—	—	C.
Doux Amer (head-grafted on Broadleaf Jersey stock in 1905)		1·056	·26	·230	—	1·052	·42	·165	—	B.
Ditto (grafted on Paradise stock)		1·057	·19	·170	17·0	—	—	—	—	E.
Dymock Red	1	1·066	·37	·152	5·7	1·057	·39	·105	—	B.
Ditto	2	1·064	·36	·144	7·3	1·056	·40	·101	—	C.
Ditto	4	1·076	·35	·182	9·1	1·062	·42	·127	—	B.
Ditto	5	1·072	·37	·248	8·6	—	—	—	—	C.

TABLE B—*continued.*

Name of Variety.	Number of Tree.	Composition of Juice, 1911.				Average Composition of Juice, 1909-11.				Method of Treatment of Tree. (See footnote.)
		Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg.C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 Deg. C.	
Écarlatine (head-grafted on Warner's King stock 1905)	1	1·066	·18	·244	3·7	—	—	—	—	C.
Ditto (grafted on Paradise stock)	—	1·064	·14	·250	—	—	—	—	—	C.
Eggleton Styre	1	1·071	·22	·134	9·2	1·067	·30	·126	—	B.
Ditto	4	1·068	·25	·154	10·5	1·057	·30	·137	—	B.
Ditto	6	1·075	·20	·140	10·3	1·060	·27	·120	—	B.
Ditto	7	1·064	·19	·138	9·2	—	—	—	—	B.
Ditto	8	1·069	·21	·188	9·7	1·059	·26	·133	—	C.
Ditto	9	1·080	·22	·206	—	1·063	·27	·138	—	C.
Fréquin Audièvre (head-grafted on Broadleaf Jersey stock in 1906)	1	1·068	·50	·412	9·3	—	—	—	—	B.
Ditto	2	1·064	·30	·340	8·3	—	—	—	—	B.
Harry Masters' Jersey (head-grafted on Warner's King stock in 1906)	—									
	1	1·079	·27	·700	5·5	1·064	·28	·413	10·8	B.
Ditto	2	1·071	·28	·540	4·8	1·064	·35	·393	—	C.
Ditto	3	1·073	·27	·656	5·0	—	—	—	—	D.
Harry Masters' Jersey	5	1·073	·25	·612	4·4	1·063	·28	·381	6·2	C.
Ditto (grafted on Paradise stock)	—	1·068	·16	·364	9·0	—	—	—	—	E.
Kingston Black	1	1·058	·40	·244	4·5	1·054	·44	·196	—	B.
Ditto	2	1·077	·58	·282	5·1	1·056	·54	·155	—	C.
Ditto	3	1·079	·58	·284	5·9	1·059	·53	·157	—	D.
Ditto	5	1·077	·54	·306	4·7	1·061	·49	·203	—	C.
Médaille d'Or	1	1·080	·21	·906	8·1	1·065	·31	·627	11·4	B.
Ditto	2	1·075	·22	·846	7·1	1·063	·28	·641	11·8	C.
Ditto	3	1·066	·21	·936	6·0	1·061	·28	·659	12·4	D.
Ditto	4	1·053	·18	·554	5·7	1·061	·28	·697	12·1	B.
Ditto	5	1·067	·19	·704	5·6	1·060	·28	·627	11·6	C.

Médaille d'Or	6	1·061	·18	·736	6·9	1·061	·26	·640	12·8	A.
Ditto	7	1·065	·21	·639	7·5	1·061	·29	·595	12·6	B.
Ditto	8	1·061	·17	·612	4·2	1·060	·26	·560	—	C.
Ditto	9	1·064	·25	·712	3·4	1·062	·28	·627	9·2	C.
Ditto	10	1·066	·25	·638	3·0	1·061	·29	·578	10·3	D.
Ditto (head-grafted on Broadleaf Jersey stock in 1906) ..		1·077	·23	·914	6·6	—	—	—	—	B.
Ditto (grafted on Paradise stock)		1·078	·23	·800	9·0	—	—	—	—	E.
M. Jacques (head-grafted on Morgan Sweet stock in 1905)	1	1·067	·40	·724	15·7	—	—	—	—	B.
Ditto	2	1·063	·43	·704	13·2	—	—	—	—	C.
Ditto (grafted on Paradise stock)		1·069	·42	·652	16·0	—	—	—	—	C.
Neverblight (head-grafted on Hardwicke stock in 1905)	1	1·048	·49	·158	5·4	—	—	—	—	B.
Ditto	2	1·051	·48	·160	4·9	—	—	—	—	C.
Ditto (head-grafted on Hardwicke stock in 1906)	3	1·057	·64	·214	3·6	—	—	—	—	D.
Ditto	4	1·058	·69	·222	3·7	—	—	—	—	B.
Reinette Obry (head-grafted on Morgan Sweet stock in 1905)	1	1·069	1·05	·144	4·7	1·055	·79	·124	8·7	B.
Ditto	2	1·060	1·13	·118	11·5	—	—	—	—	C.
Ditto	3	1·061	1·12	·126	8·7	1·051	·80	·110	11·1	D.
Ditto (grafted on Paradise stock)	—	1·063	·63	·148	14·0	—	—	—	—	
Skyrme's Kernel	3	1·070	·69	·448	—	1·052	·67	·286	—	C.
Ditto	7	1·070	·63	·532	10·2	1·057	·55	·323	12·3	B.
Ditto	8	1·087	·47	·456	11·5	1·055	·58	·318	—	C.
Ditto	9	1·060	·61	·352	11·7	—	—	—	—	C.
Ditto (grafted on Paradise stock)	—	1·054	·50	·268	—	—	—	—	—	E.
Strawberry Norman	1	1·084	·40	·456	11·3	—	—	—	—	B.
Ditto	4	1·066	·26	·476	8·6	—	—	—	—	B.
Ditto	6	1·074	·20	·396	8·1	1·060	·30	·357	8·7	A.
Ditto	7	1·069	·25	·468	5·9	1·060	·32	·393	7·3	B.
Ditto	8	1·063	·28	·260	4·9	—	—	—	—	C.
Ditto	9	1·066	·23	·524	5·1	1·063	·36	·443	—	C.
Ditto (grafted on Paradise stock)	—	1·058	·18	·356	10·4	—	—	—	—	E.

TABLE B—*continued.*

Name of Variety.	Number of Tree.	Composition of Juice, 1911.				Average Composition of Juice, 1909-11.				Method of Treatment of Tree. (See footnote.)
		Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg.C.	Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Daily Fall in Specific Gravity at 27 deg. C.	
Sweet Alford (head-grafted on King of Pippins stock in 1906) ..	1	1·070	·18	·268	7·4	—	—	—	—	B.
Ditto	2	1·071	·24	·214	5·4	—	—	—	—	C.
Ditto	3	1·067	·17	·232	5·5	1·060	·19	·166	—	D.
Ditto	4	1·066	·21	·262	—	1·057	·19	·152	—	B.
Ditto	5	1·069	·15	·226	4·7	1·057	·19	·163	—	C.
Ditto (head-grafted on Ecklinville stock in 1906)	6	1·068	·16	·210	5·6	1·060	·20	·131	—	B.
Ditto	7	1·073	·16	·202	5·2	1·061	·19	·127	—	C.
Ditto	8	1·066	·14	·206	3·9	—	—	—	—	D.
Ditto	9	1·066	·14	·168	6·7	1·056	·17	·109	—	B.
Ditto	10	1·072	·16	·212	5·0	1·055	·18	·118	—	C.
Ditto (head-grafted on Broadleaf Jersey stock in 1906)		1·066	·15	·240	3·6	1·057	·18	·136	—	C.

METHOD OF TREATMENT OF TREE:—A. Grass removed within radius of 6ft. B. Grass removed within radius of 4ft. 6in. C. Grass removed within radius of 3ft. D. Grass allowed to grow to base of tree. E. In cultivated ground.

TABLE C. Composition of Juices from Trees in Rootstock Experiment Scheme.

Name of Variety.	Rootstock.	Intermediate Stock.	Composition of Juice.			
			Specific Gravity.	Malic Acid, per cent.	Tannin, per cent.	Rate of Fermentation.
Cap of Liberty	Paradise	Brown Jersey	1·042	·62	·290	—
Ditto	Ditto	Cummy Norman ..	1·044	·60	·344	—
Ditto	Ditto	Médaille d'Or	1·096	·70	·248	—
Ditto	Ditto	Royal Jersey	1·082	·94	·202	—
Ditto	Ditto	Silver Cup	1·080	·64	·366	—
Ditto	Ditto	White Jersey	1·042	·39	·320	4·7
Dabinett	Ditto	None	1·066	·24	·352	12·6
Ditto	Ditto	Écarlatine	1·065	·29	·408	12·6
Ditto	Ditto	Kingston Black Improved	1·066	·21	·336	11·2
Ditto	Ditto	Knotted Kernel ..	1·064	·20	·576	—
Ditto	Ditto	M. Jacques	1·076	·25	·472	—
Ditto	Ditto	Neverblight	1·070	·21	·336	14·0
Ditto	Ditto	Rouge de Trèves ..	1·067	·15	·464	13·4
Ditto	Ditto	Royal Jersey	1·063	·21	·392	11·4
Ditto	Ditto	Sharpe's Summer ..	1·080	·24	·636	—
Ditto	Ditto	Thomas Hunt ..	1·070	·25	·436	—
Ditto	Ditto	White Jersey	1·070	·31	·396	—
Ditto	Ditto	White Styre	1·065	·17	·512	13·0
Ditto	Free Stock ..	None	1·067	·21	·412	8·6
Kingston Black	Ditto	None	1·070	·50	·228	7·1
Ditto	Ditto	King of the Pippins ..	1·069	·63	·258	7·2
Ditto	Paradise	Bramtôt	1·084	·50	·366	—
Ditto	Ditto	Harry Masters' Jersey..	1·084	·43	·168	—
Ditto	Crab	None	1·065	·61	·224	6·2

CIDER SICKNESS.

From time to time reference has been made in these Reports to "cider sickness." The subject is one which has occupied attention at the Institute since the investigations on cider-making were started there in 1904. The results of the observations made during that period have been of considerable service in extending our knowledge of the disorder and in suggesting methods of management of cider so that its liability to attack may be lessened. Until recently, however, it had not been possible to devote the amount of time to its study in the laboratory necessary to investigate it thoroughly. With the assistance of Mr. V. F. Hillier, of Bristol University, an attempt to gain a more satisfactory knowledge of it has lately been made. The work is not yet finished, but sufficient information has been obtained to make it worth while to publish a preliminary account of the investigation. This was given in some detail in a paper read before the British Association at the Portsmouth meeting last September, of which the following is an abstract with the addition of further results which have been since gained.

Since the general features of the disorder have been described in these pages on previous occasions, it is unnecessary to recapitulate them at greater length than to state that "sickness" is the disorder of cider, very commonly spoken of by some makers as "second fermentation," which causes in hot weather a violent fermentation of many sweet ciders, accompanied by the development of an unpleasant aroma and flavour and generally also of a dense turbidity of the liquor. It is prevalent in all the important cider-making areas in this country, although certain districts suffer more severely than others. In view of what is now known about the subject, it is evident that the fact that some localities are more prone to it than others is not due to a single cause but to a combination of factors. Sickness is a bacterial disorder, and it might therefore be supposed that the reason why certain districts invariably suffer from sickness and others generally escape is the presence or absence of the "sickness" bacteria. This is not so, however. While it is possible, and perhaps probable, that the organisms may be more abundant in some localities, there is considerable evidence to show that their distribution is very wide and that the explanation of the liability of a cider to the disorder must be sought in other directions as well. It has been found that the degree of acidity of the cider is largely responsible for its power of immunity, ciders with high acidities being less susceptible than those with low acidities. Conse-

quently ciders made from mixtures of apples in which sweet and bitter-sweet varieties predominate are far more liable to the disorder than those made from blends containing a preponderance of sharp varieties. Hence in counties like Gloucester, Hereford, Monmouth, and Worcester, in which sharp apples are plentiful, sickness is generally relatively less frequent than in Somerset and Devon, where bitter-sweet and sweet varieties are more abundant. Since also, as has been shown in an earlier Report, the rate of fermentation of the juice is important in respect of the degree of resistance to sickness, slow-fermenting juices being far more liable to it than quick-fermenting ones, the varieties of apples grown in the district have a great bearing upon the frequency of sickness in that district, seeing that some kinds normally yield slow-fermenting juices, while others give juices which ferment rapidly. The nature of the soil upon which the fruit is grown also becomes of importance in connection with sickness, since the rate of fermentation is involved, it being well known that a given variety on one kind of soil may yield a slow-fermenting juice and on another kind a rapid-fermenting one.

It is evident, therefore, that the question as to the frequency of occurrence of sickness in different localities is complicated by the influence of several distinct factors.

Although sickness crops up every year, it is far commoner in some seasons than in others. This is not difficult to understand in view of what has just been stated in connection with the distribution of the disorder. Anything affecting either the degree of acidity of the cider or the rate of fermentation of the juice must also influence its susceptibility to sickness. The nature of the season can affect the prevalence of sickness in at least four different ways. Firstly, the relative sizes of the crops of sharp, sweet, and bitter-sweet apples vary greatly in different years, the sharp varieties being generally most susceptible to unfavourable weather conditions. In this manner the degree of acidity of the cider is influenced. (It is worthy of remark in this connection that the same result is sometimes produced artificially by the demand for sharp apples in some seasons for jam-making and other market purposes. Cider-makers and growers would be well advised therefore to take precautions to prevent any serious shortage of sharp fruit.) The rate of fermentation is also affected in a similar way. Secondly, the nature of the season is directly responsible for the quality of the fruit and its juice, the acidity after cold, sunless summers being generally considerably higher than after warm, sunny ones. Thirdly, the rate of fermentation of the juice is directly affected for the same reason.

Fourthly, the temperature to which the cider is exposed after its primary fermentation has ceased is of influence. High temperatures favour sickness. Consequently it appears as a rule more frequently in hot than in cool summers.

The malady is not confined to this country. The accounts of apparently similar disorders which have been recorded in other cider-producing countries are for the most part not sufficiently detailed to allow with certainty their identification with that now under consideration; but there seems to be no doubt from the descriptions given that the disorder termed "maladie de la pousse" or "maladie de la tourne," which affects French cider is the same as "sickness." It does not, however, appear to have been closely investigated, and has been regarded as analogous to the disorder of the same name which affects light wines. There are many points of resemblance between the latter and cider sickness, but the characters of the organisms causing the two disorders and the chemistry of the changes produced by their action differ in several important respects.

The changes in cider caused by sickness can be classed under three heads:—

(*a*) The development of a peculiar and characteristic aroma and flavour.

(*b*) The production of a more or less copious turbidity or deposit.

(*c*) The destruction of sugar, accompanied by an evolution of gas.

While all occur in a typical case of sickness, it frequently happens that the character of the disorder as manifested varies considerably. These variations have been described in the Report previously referred to, and are due to the absence or modification of the two latter series of changes. Occasionally instances of violent "second fermentation" or of marked turbidity unaccompanied by the characteristic "sickness" flavour and aroma occur, but no proof has yet been forthcoming to indicate that they are caused by "sickness" bacteria; and the balance of evidence is clearly in favour of the view that sickness in cider is always accompanied by the production of the characteristic flavour and aroma. Assuming that to be correct, the latter are the only features to be relied on as constant in an attack of sickness.

The chemistry of these changes is still under investigation; but some of the principal features have been examined.

The aroma and flavour are mainly, if not entirely, due to the formation of certain volatile organic compounds. While it is

possible that one particular substance may be the primary cause of the flavour and aroma, it is certain that those features are complex in character, and the result of the presence of several distinct compounds. Their identification is a difficult matter, since they are probably not present in quantities larger than mere traces, and consequently cannot be isolated and analysed. The presence of acetaldehyde has been proved, and other aldehydes possibly also occur. Certain volatile organic acids, among which acetic acid and butyric acid are prominent, have also been noted. The decomposition of the sugar by the bacteria is accompanied by the formation of a characteristic odour, somewhat similar to that of decaying lemons, and due probably to one or more volatile organic acids not yet recognised. The aroma of a pure sugar solution fermented by the " sickness " bacterium is quite distinct from that of sick cider. It is highly probable that there is some constituent peculiar to apple and pear juice—the characters of cider and perry sickness correspond in all essential particulars—which is decomposed by the bacteria and yields the compound or compounds which give to the aroma and flavour of sick cider the characteristic feature which distinguishes it from those of all other fermentable liquids thus far tested with the bacteria. Under some conditions an appreciable odour of sulphuretted hydrogen has also been detected.

The turbidity and deposit are due mainly to the deposition of an insoluble substance in the cider. Experiments point to the probability that this is a product of the decomposition of part of the tannins and related bodies in the cider, since a similar product has been obtained in sugar solutions containing tannic acid fermented with the bacterium, while sugar solutions without tannin treated similarly give no deposit or turbidity of the same character.

The third series of changes occurring during sickness, viz., the violent fermentation and disappearance of the sugar, are characteristic of cider sickness as a bacterial phenomenon in respect of the products of the action, and serve to distinguish the sickness organisms from others previously studied which are able to ferment sugar. The gas given off during fermentation consists almost entirely of carbon dioxide, the remainder, which does not exceed 5 per cent., being principally, if not entirely, hydrogen. In this respect the action closely resembles normal alcoholic fermentation of sugar by yeast. It also resembles the latter in the production of a relatively large quantity of ethyl alcohol, quantitative experiments having shown that the equation for the decomposition of the sugar by the bacterium works out almost identically with that for yeast. Other products of the decomposition of the sugar are acetaldehyde,

and acetic, butyric, and oxalic acids. The decomposition of the sugar seems to be, as a rule, more or less incomplete, and there is some evidence to show that part of it is not fermented in the above fashion, but is converted into a substance of entirely different character.

The malic acid naturally present in cider is also attacked by the bacterium. Except, however, in relatively sharp ciders, *i.e.*, those with acidity above ·6 per cent., sickness does not result in any diminution of the total acidity, the loss due to the decomposition of the malic acid being more than compensated for by the formation of small quantities of acetic, butyric, oxalic, and, possibly, other organic acids.

The susceptibility of a cider to sickness depends upon a number of factors to which passing reference has already been made in the earlier part of this article. The most important are the rate of fermentation of the cider, its degree of sweetness, its acidity, and the temperature at which it is stored.

It has been previously shown that juices which ferment rapidly yield ciders which are not nearly so susceptible to sickness as those which ferment slowly. This result appears to be due to two reasons. Firstly, a rapid primary fermentation of the juice indicates that the yeasts are comparatively well nourished and are therefore able to multiply freely and set up a vigorous alcoholic fermentation. Those conditions seem to prevent any considerable development of the sickness bacteria during the period of active primary fermentation, with the result that when the stage of the arrest of this fermentation is reached, the number of the bacteria present in the cider is relatively small, and their vitality very feeble,—possibly none may survive to this stage—and consequently the liability of such a cider to sickness is very small unless infection with active bacteria is allowed to take place later. Secondly, a rapid rate of fermentation generally means that very little sugar remains in the mature cider. The sickness bacteria are, therefore, unable to flourish owing to the lack of suitable carbohydrate food.

Seeing that sugar is required by the bacteria for their active multiplication, it follows that the degree of sweetness of the mature cider is a factor of importance in relation to the question of the liability of that cider to sickness. If the amount of sugar present is small, sickness, if it occurs at all, can only be slight. If the amount exceeds 3 or 4 per cent., the attack of sickness may be severe. Whenever sugar above that amount is present, there must always be risk of sickness. *Per contra*, the absence of sugar means

immunity from sickness. These facts should be well considered by those who aim at the production of a sweet cider.

The natural acidity of the cider is of the first importance in connection with susceptibility to sickness. As a general rule, the more malic acid there is present in a cider the less liable it is to sickness. Experiments have shown, however, that unless the amount of malic acid exceeds ·45 or ·5 per cent., it is insufficient by itself to prevent sickness. Ciders containing larger quantities than those mentioned occasionally turn sick if other conditions are very favourable to sickness, and amounts above 1 per cent. are required if there is to be any degree of certainty as to the ability of the cider to remain immune from sickness.

The temperature at which the cider is stored is of considerable importance. Storage in a warm place greatly favours sickness; but the cooler the temperature the longer and the better able is the cider to resist sickness. The risk of the development of sickness in a cider stored below 50°F. is inconsiderable.

It is interesting to note that, although tannin is popularly supposed to have an important action in cider as a preventive of bacterial disorders, and on that account the use of a large proportion of bitter-sweet apples has been recommended by most authorities, in the case of sickness that substance, in the amounts commonly present in pronounced bitter-sweet varieties, does not seem to offer the slightest check to the growth of the bacteria; and the use of bitter-sweets actually favours the disorder on account of the low acidity of their juice.

Earlier experiments had made it certain that the ultimate cause of cider-sickness was the development of a certain organism or organisms in the liquor. The flora of sick cider was found on examination to be very complex, many types of bacteria and yeasts being present. A large number of different forms were isolated from time to time from sick ciders, but none proved to be capable of inducing sickness in a sound cider. Last spring, however, by the use of special methods which had been suggested by previous results, a bacterium capable of producing all the symptoms of sickness in a sound sterilised cider was successfully isolated. Its characters and life history have since been fully studied. It is unnecessary to go into details here with regard to its general characters and relationships. Its properties, as far as they are concerned with cider sickness, have already been indicated in the foregoing account of the disorder. Thus the organism ferments grape and fruit sugars, decomposing them in the manner outlined above. It also produces the characteristic flavour and aroma of sickness in sterilised

cider infected with a pure culture of the organism, and gradually causes the precipitation of the substance which is responsible for the turbidity of sick cider. Its growth practically ceases at temperatures below 55°F., and is very slow except between 70°F. and 95°F. Growth ceases above 104°F., and the organism is killed on exposure for five minutes to a temperature of 135–140°F. No spore formation has been observed. It does not flourish in an acid medium, and can only grow with difficulty if the acidity is higher than ·6 per cent. malic acid.

This investigation has proved valuable on account of the suggestions which it offers for the prevention of cider sickness in practical cider-making. It is evident that the sickness bacteria are very widely spread, and that they are to be found in many, if not all, freshly pressed juices. Consequently the surest means of warding off the disorder is to produce a type of cider more or less immune to their attacks. This can to a large extent be accomplished by blending, as pointed out in an earlier Report, the aim being to produce a cider capable of a vigorous and fairly rapid rate of fermentation and possessing an acidity as high as considerations of palatability will allow. After fermentation, it should be stored at as low a temperature as possible. Experiments with bottled ciders show conclusively that early bottling greatly reduces the risk of sickness.

Since the disorder is caused by bacteria, it is important that strict attention should be paid to cleanliness; and it is desirable that all vessels and appliances with which the juice or cider comes in contact should be sterilised as efficiently as possible by steam or by washing with a suitable antiseptic, so that risk of infection may be reduced. It is possible also that a satisfactory method of sterilising the fruit, and of thus preventing any entry of the bacteria into the juice from that source, may be devised, either by washing in water containing an antiseptic or in hot water. Experiments in this direction are now in progress.

Investigations on Spray Fluids.

The Fungicidal Action of Bordeaux Mixture.

The past decade has witnessed the introduction of spraying for the protection of certain cultivated crops against the ravages of insect and fungoid pests as a regular part of the routine of the agriculturalist and horticulturist. Our knowledge of spray fluids and their action is still in its infancy; and there is no doubt that

every year large sums of money are absolutely wasted on worthless spraying solely because of ignorance of the action of the various washes applied and the conditions requisite for their successful use. There is at the present time great need for a systematic study of the mode of action of the most commonly used washes. This aspect of the subject has been given attention at the Institute for some time past, and during the last two years the fungicidal action of Bordeaux mixture has been closely studied. The work has been carried out in collaboration with Mr. C. T. Gimingham, F.I.C., Lecturer in Agricultural Chemistry at Bristol University, and the earlier results were published last May in the *Journal of Agricultural Science*. The following summary of the work deals mainly with those points which are of more or less direct practical bearing.

The chemistry of Bordeaux mixture is complicated, and was little understood until Pickering published the results of his work in the Reports of the Woburn Experimental Fruit Farm and elsewhere. He showed that the addition of lime, in gradually increasing amounts, to solutions of copper sulphate, resulted in the formation of a series of basic sulphates of copper. The compound finally present in ordinary Bordeaux mixture, made from equal weights of lime and copper sulphate, is a substance consisting of one of those basic sulphates in combination with lime. When the Bordeaux mixture is made from lime-water instead of the usual milk of lime, the compound formed depends upon the proportion of lime-water used. According to Pickering, when any of these compounds are sprayed on foliage they are gradually decomposed by the carbon dioxide of the air, and copper carbonate together with some copper sulphate is formed. To the latter, which is soluble, he attributes the main fungicidal action of Bordeaux mixture. Since lime is attacked by carbon dioxide more readily than the basic copper sulphate, it follows that in Bordeaux mixtures containing an excess of lime, such for example as the ordinary mixture, there will be little copper sulphate liberated until the lime has been completely carbonated. According to Pickering's view, therefore, it is better to use a form of Bordeaux mixture containing no excess of lime than one with excess of this substance, since it will become actively fungicidal more quickly. Hence he introduced the form of the mixture now known as Woburn Bordeaux paste, which contains no excess of lime and which is claimed to be much more efficient than the ordinary form. It is therefore asserted that it is a much more economical spray to use, since much less copper sulphate than in ordinary Bordeaux mixture is required to produce the same effect. If Pickering's hypothesis is correct, it is evident that the sooner the

general use of the ordinary mixture is replaced by that of the Woburn paste the better; but it is desirable that the evidence in its favour should be conclusive, and to that end it is necessary that the manner of the fungicidal action of the various forms of Bordeaux mixture should be thoroughly investigated. Hitherto attention has been specially given to the purely chemical side of the question; but in the work which has recently been done at the Institute the biological aspect has been specially dealt with.

It has been generally assumed that the root of the matter consists in the determination of the manner in which the insoluble copper compounds of the various types of Bordeaux mixtures are rendered soluble. There appear to be three possible modes :—

(1) Atmospheric agencies, especially the carbon dioxide of the air, may be responsible. This explanation is purely chemical, and is the one favoured by Pickering.

(2) The foliage of the sprayed plants may exercise a solvent action.

(3) The fungus against which the spraying is directed may be itself the cause, owing to the secretion of substances capable of dissolving the insoluble copper deposit.

Mr. Gimingham has examined in some detail the action of carbon dioxide upon the copper compounds present in Bordeaux mixtures, and has come to the conclusion that the results make it impossible to assign their fungicidal action to copper sulphate liberated by atmospheric carbon dioxide. It is, however, possible that rain or dew may exert a slight solvent action apart from any dissolved dioxide they may contain. Some results obtained in the United States by Crandall favour that idea, but the evidence is hardly conclusive and there is some reason to believe that the solution of the copper which he observed may have been accomplished by excretions from injured foliage on the sprayed trees.

With regard to a direct solvent action by the sprayed foliage itself upon the copper deposit, the whole of the evidence obtained points strongly to the conclusion that under ordinary conditions uninjured leaves do not possess at the most more than a very slight solvent power, and that the existence of any at all is very problematical. On the other hand, injured foliage does exert a distinct solvent action, even although the injuries may be almost microscopic. In practice it is doubtful whether there is any considerable number of leaves on fruit trees free from injury of some sort; and therefore the injury factor as a means of rendering some of the

copper in the Bordeaux deposit soluble is one which must be reckoned with. The scorching which so commonly occurs after spraying with Bordeaux mixture, is probably due mainly, if not entirely, to the copper rendered soluble by excretions from injured portions of leaves penetrating at the point of injury to the inner delicate tissues of the leaf and causing damage to them. It is well known, for example, that serious scorching occurs after severe attacks on foliage by insect or fungoid pests, the injuries caused by the parasite being directly responsible for the result.

The possibility of a direct solvent action by the fungus in the Bordeaux deposit has been frequently considered by earlier workers on the subject, and there has been much conflict of opinion over the results. The question could certainly not be considered to have been definitely settled. As the result of a large number of experiments at the Institute there is now strong evidence in favour of the view that many fungi, if not all, can exert a solvent action. The behaviour of a variety of fungus spores in relation to the copper compounds of various Bordeaux mixtures has been examined, and it has been found that, although little or no action is apparent if the spores are not actually in contact with particles of the copper compounds or in very close proximity, direct contact between a spore and a particle of the copper compound may result in the death of the spore. Spores with thick resistant walls are not generally affected; but those with thin walls, or the thin-walled delicate germ tubes of thick walled spores, are almost invariably killed by contact with the insoluble copper compound. This points directly to the power of thin-walled fungus cells to act on the copper and produce a soluble compound which is absorbed by the organism and thus causes its death.

It is true that the basic sulphates of copper are not absolutely insoluble, and that if the dissolved traces were to be removed by fungus spores or otherwise, more would at once pass into solution. It is thus possible to imagine a gradual accumulation of copper in a germinating fungus spore, which might finally become sufficient to cause death. There would be, as it were, a race between the rate of absorption of copper and the rate of growth of the fungus. The possibility of a cumulative action was considered in the paper referred to above, and has recently been favoured by Pickering. The results already mentioned have, however, made such an explanation difficult to accept, since spores were found to germinate and grow in the presence of the basic copper sulphate so long as they were not in actual contact with solid particles of that substance.

On the whole it seems probable that Bordeaux mixtures are effective as fungicides mainly because the fungi themselves, except when in a resting condition, act upon any portions of the insoluble copper compound with which they may come in contact, absorbing a soluble product and thus actually poisoning themselves. Some soluble copper compounds may also be formed by atmospheric agencies, and by leaf action after injury; but neither of these actions appears to have been conclusively demonstrated to be the cause of the presence of sufficient soluble copper to account for the undoubted fungicidal properties of Bordeaux mixtures.

If these ideas are correct, they have a direct bearing upon the practical side of Bordeaux spraying. It becomes absolutely essential to spray thoroughly, so that the leaf surfaces liable to infection may be covered as completely as possible with the deposit copper of the compound and thus give little opportunity for the development of any fungus spore which may alight upon them. For the same reason it is important to prepare the spray fluid in such a way that the copper precipitate is obtained in as finely a state of division as possible. It is also important to give attention to the adhesive properties of the spray, so that it may remain as a coat on the foliage for as long a period as possible.

In a word, the physical rather than the chemical properties of the precipitate in the spray fluid, are of primary importance; and indeed it appears probable that, were it not for their manifold differences mechanically and physically, all insoluble copper compounds of the type under discussion might be equally efficacious as fungicides for a given weight of copper present.

These ideas explain, also, why Bordeaux mixture is effective as a fungicide from the moment of its application, a view generally held by practical experts. According to Pickering's atmospheric action hypothesis ordinary Bordeaux mixture would not be effective until all the lime had been carbonated by the carbon dioxide of the air.

Their bearing upon the question of the relative efficiencies of the Woburn Bordeaux mixture and the ordinary mixture is considerable. Assuming two leaves to be equally well coated with those sprays, preference would be given to the former, since the film in that case would consist entirely of the copper compound, whereas in the latter the copper particles would be interspersed with unchanged lime and the gaps made by the latter might afford opportunity for attack by the fungus at those points. The relations between the lime and the fungus, however, must be taken into account, and there are also other factors which enter into the question and com-

plicate it. However, it certainly seems that a coating of the Woburn mixture as complete in respect of copper as that of the ordinary mixture may be necessary, and consequently it does not appear likely that the total quantity of copper used for the former can be reduced much below the amount required by the latter. It is possible, moreover, that the presence of excess of lime in the ordinary mixture may act detrimentally on the fungicidal value of the copper, in which case the Woburn mixture with no excess of lime will hold a distinct advantage.

Such points require further investigation, and work in the laboratory must be supplemented by thorough tests in the field before a final decision as to the best form of Bordeaux mixture can be attained.

APPENDIX A.—Analyses of Apples and Pears, 1911–12.

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.			Rate of Fermentation.	Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES.							
ANNUAL SOURINGS	1·079	17·25—19·25	·77	·276	9·8	H. Knight	Huntley G.
ANSELL	1·073	15·75—17·75	·81	·400	6·1	Ditto	Ditto
ASHTON WHITE	1·062	13 — 15	·21	·516	6·4	Cider Institute	Long Ashton S.
ASTON MILL	1·060	12·5 —14·5	·31	·360	—	H. Knight	Huntley G.
BACKWELL RED	1·056	11·5 —13·5	·72	·140	4·2	G. R. Horler	Backwell S.
Ditto	1·053	10·75—12·75	·59	·058	2·1	Ditto	Ditto
BASTARD FOXWHELP	1·060	12·5 —14·5	·78	·140	3·2	J. Davies	Marden H.
BELLE NORMAN	1·073	15·75—17·75	·27	·488	10·7	J. Powell	Monmouth
BESS POOL	1·071	15·25—17·25	·80	·260	4·1	H. Knight	Huntley G.
BICKFORD'S No. 1	1·070	15 — 17	·71	·292	4·4	J. W. F. Bickford	Barton D.
Ditto No. 2	1·066	14 — 16	·57	·216	4·9	Ditto	Ditto
Ditto No. 3	1·065	13·75—15·75	·48	·224	5·5	Ditto	Ditto
Ditto No. 4	1·060	12·5 —14·5	·56	·216	5·3	Ditto	Ditto
Ditto No. 5	1·069	14·75—16·75	·57	·232	8·8	Ditto	Ditto
BICKINGTON NATURAL	1·060	12·5 —14·5	·42	·300	4·8	Ditto	Ditto
BITTERSWEET	1·067	14·25—16·25	·26	·376	6·2	H. Knight	Huntley G.
BLACK FOXWHELP	1·059	12·25—14·25	·53	·276	6·4	J. Davies	Marden H.
BLACKEYED PIPPIN	1·057	11·75—13·75	·29	·392	6·0	Ditto	Ditto
BLACKTHORN NORMAN	1·064	13·5 —15·5	·18	·436	4·6	H. J. Davis	Sutton Montis S.
BLENHEIM ORANGE	1·068	14·5 —16·5	·63	·144	6·6	J. W. F. Bickford	Barton D.
BRAMTOT	1·085	18·75—20·75	·28	·644	6·1	C. Osborn	Woolston S.
Ditto	1·075	16·25—18·25	·44	·684	6·9	J. Davies	Marden H.
Ditto (Paradise Stock)	1·057	11·75—13·75	·66	·256	11·0	Cider Institute	Long Ashton S.
BRAN ROSE	1·061	12·75—14·75	·34	·284	6·1	J. Davies	Marden H.
BRANDY RED STRIPE	1·069	14·75—16·75	·80	·312	13·5	Ditto	Ditto
BRICE'S KERNEL	1·047	9·25—11·25	·75	·134	3·0	W. Wallis	Tewkesbury H.
BROADLEAF NORMAN	1·059	12·5 —14·5	·20	·354	7·3	Cider Institute	Long Ashton S.
Ditto	1·062	13 — 15	·27	·128	5·6	R. J. Hinckes	Bishopston H.

Ditto	1·055	11·25—13·25	·14	·264	7·2	J. Davies	Marden	H.
BROMLEY	1·064	13·5 - 15·5	·51	·356	7·0	Ditto	Ditto	
BULL'S EYE	1·055	11·25 — 13·25	·54	·216	9·7	Ditto	Ditto	
Ditto	1·055	11·25—13·25	·79	·084	11·0	Ditto	Ditto	
BURSTOUT	1·064	13·5 —15·5	·19	·134	4·3	W. Allen	South Petherton	S.
BUSKIN	1·071	15·25—17·25	·40	·168	5·6	C. Osborn	Woolston	S.
BUTLEIGH No. 12	1·072	15·5 —17·5	·26	·472	8·3	R. Neville Grenville	Butleigh	S.
Ditto No. 14 (Original Tree)	1·091	20·25—22·25	·22	·536	9·8	Ditto	Ditto	
Ditto No. 14 (Young Tree)	1·094	21 — 23	·19	·444	5·4	Ditto	Ditto	
Ditto No. 14 (Seedling) ..	1·084	18·5 —20·5	·16	·336	—	Ditto	Ditto	
Ditto No. 101	1·078	17 — 19	·20	·364	4·3	Ditto	Ditto	
BUTTER BOX	1·055	11·25- 13·25	·62	·158	4·6	J. W. F. Bickford ..	Barton	D.
CADBURY, No. 3..	1·060	12·5 - 14·5	·14	·348	5·0	C. Osborne ..	Woolston	S.
CAP OF LIBERTY	1·069	14·75 16·75	·85	·302	4·5	C. Porter	East Lambrook	S.
Ditto	1·072	15·5 —17·5	·82	·326	3·9	J. H. Symes ..	Martock	S.
Ditto	1·072	15·5 —17·5	·80	·280	4·6	H. J. Davis.. ..	Sutton Montis	S.
Ditto	1·071	15·25—17·25	·89	·372	3·7	C. Osborn	Woolston	S.
Ditto (Seedling) ..	1·081	17·75—19·75	1·31	·452	12·7	Cider Institute ..	Long Ashton	S.
CHERRY NORMAN	1·060	12·5 - 14·5	·24	·252	6·1	Cider Institute ..	Long Ashton	S.
Ditto	1·063	13·25—15·25	·74	·336	7·3	J. Davies	Marden	H.
Ditto	1·052	10·5 —12·5	·19	·368	3·7	Ditto	Ditto	
Ditto	1·054	11 — 13	·23	·372	4·7	J. Ford	Withington	H.
CHERRY PEARMAIN	1·060	12·5 —14·5	·41	·304	10·5	Ditto	Ditto	
Ditto	1·068	14·5 —16·5	·64	·174	3·8	J. Davies	Marden	H.
CHISEL JERSEY	1·077	16·75—18·75	·21	·768	2·3	R. Neville Grenville	Butleigh	S.
Ditto	1·066	14 — 16	·33	·428	5·0	C. Osborn	Woolston	S.
CHEVALIER	1·057	11·75—13·75	·19	·298	13·7	Cider Institute ..	Long Ashton	S.
CIDER PEARMAIN	1·065	13·75—15·75	·33	·240	7·8	J. Davies	Marden	H.
CIDER PIPPIN	1·066	14 — 16	·75	·232	7·3	Ditto	Ditto	
CIDER QUARRENDEN ..	1·077	16·75—18·75	·53	·244	3·0	C. Osborn	Woolston	S.
CLUSTER	1·057	11·75—13·75	·24	·272	5·4	J. Knight	Iddesleigh	D.
COCCAGEE	1·070	15 — 17	·63	·364	6·7	J. Davies	Marden	H.
COUNTY NORMAN	1·062	13 — 15	·71	·344	4·9	H. Knight	Huntley	G.
COWARNE RED	1·059	12·25—14·25	·63	·360	3·6	C. Osborn	Woolston	S.
Ditto	1·068	14·5 —16·5	·60	·340	6·0	H. Knight	Huntley	G.
Ditto	1·066	14 — 16	·54	·272	8·5	J. Ford	Withington	H.

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.			Rate of Fermentation.	Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES—*continued.*							
COX'S ORANGE PIPPIN ..	1·078	17 — 19	·47	·168	18·0	J. Davies	Marden H.
CROCKER'S No. 1	1·061	12·75—14·75	·29	·204	3·5	J. Crocker	Heatherleigh D.
Ditto No. 2	1·061	12·75—14·75	·39	·116	5·4	Ditto	Ditto
Ditto No. 3	1·062	13 — 15	·42	·118	8·5	Ditto	Ditto
CUMMY NORMAN	1·070	15 — 17	·20	·292	3·0	J. Davies	Marden H.
Ditto	—	—	·24	·416	—	Miss H. Glinn ..	Eigne H.
DABINETT	1·074	16 — 18	·25	·416	8·1	C. Osborn	Woolston S.
DAVIES' No. 1	1·066	14 — 16	·22	·376	—	J. Davies	Marden H.
DAVIS' FAVOURITE	1·055	11·25—13·25	·16	·296	3·6	H. J. Davis ..	Sutton Montis S.
DOUX AMER	1·069	14·75—16·75	·21	·344	10·8	J. Hawkins ..	Brockley S.
DOVE SEEDLING	1·070	15 — 17	·25	·240	—	H. J. Davis.. ..	Sutton Montis S.
DUFFLIN	1·063	13·25—15·25	·90	·186	2·5	J. C. Daubuz ..	Truro C.
DUGDALE	1·070	15 — 17	·18	·260	10·0	J. Davies	Marden H.
DYMOCK RED	1·059	12·25—14·25	·53	·432	3·1	J. Ford	Withington H.
EARLY RED JERSEY	1·056	11·5 —13·5	·18	·616	5·1	Cider Institute ..	Long Ashton S.
EASTHAM	1·065	13·75—15·75	·33	·246	4·2	Rev. E. E. Lea ..	Eastham W.
FAIR MAID OF DEVON, No. 1..	1·072	15·5 —17·5	·48	·308	6·7	H. C. Hancock ..	Milverton S.
FARMER'S FRIEND	1·065	13·75—15·75	·28	·342	15·0	C. Porter	E. Lambrook S.
FERTILE DE CAEN	1·077	16·75—18·75	·35	·384	4·7	J. Davies	Marden H.
FERTILE DE FALAIS	1·061	12·75—14·75	·16	·612	3·5	J. Hawkins ..	Brockley S.
FILL BARREL	1·078	17 — 19	·32	·488	6·4	C. Osborn	Woolston S.
Ditto	1·072	15·5 —17·5	·81	·244	—	H. Knight	Huntley G.
FOOTLAND'S No. 2	1·056	11·5 —13·5	·78	·164	11·5	R. Neville Grenville	Butleigh S.
FOXWHELP	1·064	13·5 —15·5	·69	·368	4·5	J. C. Daubuz ..	Truro C.
Ditto	1·063	13·25 —15·25	·72	·336	3·6	H. Knight	Huntley G.
Ditto	1·067	14·25—16·25	·49	·220	8·2	J. Bott	Breinton H.
FRANCE	1·051	10·25—12·25	·35	·172	5·4	J. C. Ahier	Jersey
FREDERICK	1·062	13 — 15	·95	·094	2·2	S. W. Mullins ..	Dingestow M.
FRENCH OLD BOY	1·067	14·25—16·25	·83	·232	4·3	H. Knight	Huntley G.

FRÉQUIN AUDIÈVRE	1·066	14 — 16	·22	·448	6·1	J. Hawkins ..	Brockley S.
Ditto	1·096	14·75—16·75	·31	·448	5·0	Cider Institute ..	Long Ashton S.
FRÉQUIN DE CHARTRES ..	1·076	16·5 —18·5	·21	·206	6·1	J. Hawkins ..	Brockley S.
GATCOMBE	1·063	13·25—15·25	·44	·244	3·4	W. Butler	Long Ashton S.
GEORGE JAMES	1·071	15·25—17·25	·19	·332	5·5	C. Osborn	Woolston S.
GLASTONBURY JERSEY ..	1·079	17·25—19·25	·37	·644	7·8	W. Masters ..	Barton St. David S.
GLORY OF THE WEST ..	1·087	19·25—21·25	·27	·716	5·7	H. J. Davis ..	Sutton Montis S.
GREEN WILDING	1·060	12·5 —14·5	·17	·368	6·1	J. Davies	Marden H.
Ditto	1·055	11·25—13·25	·14	·300	4·4	J. Davies	Ditto
HALL DOOR	1·073	15·75—17·75	·94	·232	5·4	J. Davies	Marden H.
HANDSOME NORMAN	1·067	14·25—16·25	·22	·452	9·8	Ditto	Ditto
Ditto	1·052	10·5 —12·5	·30	·464	7·5	J. Ford	Withington H.
HARRY MASTERS	1·072	15·5 —17·5	·34	·512	6·9	H. J. Davis ..	Sutton Montis S.
Ditto	1·066	14 — 16	·24	·456	10·0	Ditto	Ditto
Ditto	1·067	14·25—16·25	·15	·428	4·8	C. Osborn	Woolston S.
HAWTHORNDEN	1·059	12·25—14·25	·48	·140	6·0	H. Knight	Huntley G.
HAYWOOD KERNEL	1·057	11·75—13·75	·37	·156	4·9	Ditto	Ditto
HEREFORD BITTERSWEET ..	1·063	13·25—15·25	·39	·456	8·0	J. Davies	Marden H.
HINCKES' No. 1 (Bishopston Court)	1·061	12·75—14·75	·20	·152	6·5	R. J. Hinckes ..	Bishopston H.
HOBBS' JERSEY	1·061	12·75—14·75	·29	·272	12·0	H. J. Davis ..	Sutton Montis S.
HORNER	1·075	16·25—18·25	·15	·286	11·1	C. Osborn	Woolston S.
Ditto	1·073	15·75—17·75	·18	·420	4·6	H. J. Davis ..	Sutton Montis S.
Ditto	1·078	17 — 19	·18	·318	3·9	R. Neville Grenville	Butleigh S.
Ditto	1·065	13·75—15·75	·24	·284	3·9	J. Knight	Iddesleigh D.
Ditto (Seedling)	1·054	11 — 13	·11	·158	7·4	C. Osborn	Woolston S.
JONES' SEEDLING	1·068	14·5 —16·5	·38	·344	9·2	Cider Institute ..	Long Ashton S.
KINGSTON BLACK	1·067	14·25—16·25	·58	·256	4·2	J. C. Daubuz ..	Truro C.
Ditto	1·054	11 — 13	·69	·164	3·5	F. Ford	Hereford H.
Ditto	1·085	18·75—20·75	·78	·258	3·2	W. Wallis	Tewkesbury C.
Ditto	1·072	15·5 —17·5	·61	·226	3·5	R. Neville Grenville	Butleigh S.
Ditto	1·076	16·5 —18·5	·58	·272	4·5	C. E. J. Walkey ..	Staplegrove S.
Ditto	1·087	19·25—21·25	·38	·330	9·0	H. J. Davis ..	Sutton Montis S.
Ditto	1·067	14·25—16·25	·46	·228	3·0	J. H. Symes ..	Martock S.
Ditto	1·076	16·5 —18·5	·42	·272	4·0	C. Osborn	Woolston S.
Ditto	1·074	16 — 18	·63	·252	3·2	C. Porter	East Lambrook S.
Ditto	1·076	16·5 —18·5	·59	·272	4·4	J. Watts	Huntspill S.

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.			Rate of Fermentation	Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES—*continued.*							
KINGSTON BLACK	1·073	15·75—17·75	·40	·468	3·9	H. Knight	Huntley G.
Ditto	1·088	19·5 —21·5	·59	·484	4·6	C. E. J. Walkey ..	Staplegrove S.
Ditto	1·078	17 —19	·45	·252	11·0	J. Bott	Breinton H.
Ditto (Old Orchard)	1·085	18·75—20·75	·82	·326	8·7	Cider Institute ..	Long Ashton S.
KINGSTON RED	1·070	15 —17	·45	·352	8·7	J. Davies	Marden H.
KNOTTED KERNEL	1·083	18·25—20·25	·12	·308	—	Cider Institute ..	Long Ashton S.
LADY'S FINGER	1·072	15·5 —17·5	·22	·304	4·9	J. Davies	Marden H.
LEATHER JACKET	1·063	13·25—15·25	·21	·644	4·7	C. Osborn	Woolston S.
LEDBURY NORMAN	1·068	14·5 —16·5	·21	·668	5·5	Miss H. Glinn ..	Eigne H.
LONG STEM	1·062	13 —15	·18	·724	4·1	C. Osborn	Woolston S.
MAGGS' SEEDLING	1·061	12·75—14·75	·76	·132	7·0	Cider Institute ..	Long Ashton S.
MAJOR	1·067	14·25—16·25	·34	·400	5·7	J. Crocker	Heatherleigh D.
M. JACQUES	1·073	15·75—17·75	·68	·696	5·3	J. Hawkins ..	Brockley S.
MÉDAILLE D'OR	1·056	11·5 —13·5	·41	·636	5·7	Cider Institute ..	Long Ashton S.
Ditto	1·085	18·75—20·75	·24	1·136	6·9	H. J. Davis ..	Sutton Montis S.
Ditto	1·066	14 —16	·30	·496	4·5	J. C. Daubuz ..	Killiow C.
MERTON NATURAL	1·050	10 —12	·22	·276	6·7	J. W. F. Bickford ..	Barton D.
MIDDLE STREAK	1·071	15·25—17·25	·16	·620	4·2	C. Osborn	Woolston S.
MUSCADET	1·084	18·5 —20·5	·27	·532	7·0	J. Hawkins ..	Brockley S.
NEVERBLIGHT	1·055	11·25—13·25	·45	·268	9·0	C. Osborn	Woolston S.
Ditto	1·058	12 —14	·36	·284	9·6	Ditto	Ditto
NEVER DECEIVE ME	1·071	15·25—17·25	·17	·256	3·1	R. Neville Grenville	Butleigh S.
NEW CADBURY	1·071	15·25—17·25	·20	·296	6·3	Ditto	Ditto
NEW FOXWHELP	1·059	12·25—14·25	·74	·210	4·3	J. Davies	Marden H.
Ditto	1·057	11·75—13·75	·36	·146	8·2	Ditto	Ditto
NEWTON RED JERSEY ..	1·056	11·5 —13·5	·33	·332	4·5	A. E. Ellis ..	Newton St. Cyres D.
NOIR DE VITRY	1·063	13·25—15·25	·27	·192	8·4	J. Hawkins ..	Brockley S.
NORMANDY FRENCH ..	1·065	13·75—15·75	·91	·512	4·4	H. Knight	Huntley G.

OATLEY'S KERNEL	1·064	13·5 —15·5	·52	·240	10·2	J. Davies	Marden	H.
OLD CADBURY	1·085	18·75—20·75	·14	·508	5·1	R. Neville Grenville	Butleigh	S.
OLD FOXWHELP	1·060	12·5 —14·5	·55	·312	5·5	J. Davies ..	Marden	H.
PASSE REINE DES POMMES	1·085	18·75—20·75	·31	·788	7·3	J. Hawkins ..	Brockley	S.
PHILIP NORMAN	1·071	15·25—17·25	·18	·340	7·7	H. J. Davis ..	Sutton Montis	S.
Ditto	1·069	14·75—16·75	·20	·338	13·0	C. Osborn	Woolston	S.
Ditto	1·065	13·75—15·75	·17	·456	7·8	Ditto	Ditto	
POMEROY	1·058	12 —14	·59	·328	6·1	Ditto	Ditto	
PORTER'S PERFECTION ..	1·048	9·5 —11·5	·42	·312	3·7	C. Porter	East Lambrook	S.
PORT WINE	1·064	13·5 – 15·5	·22	·484	8·7	H. J. Davis ..	Sutton Montis	S.
Ditto	1·067	14·25—16·25	·20	·684	4·7	C. Osborn	Woolston	S.
PRIDE OF AUSTRALIA ..	1·048	9·5 —11·5	·57	·208	7·7	Cider Institute ..	Long Ashton	S.
QUEENINGS	1·047	9·25—11·25	·29	·144	3·4	J. Skyrme	Lulham	H.
RED CLUSTER	1·074	16 —18	·50	·376	4·7	J. Davies ..	Marden	H.
RED FOXWHELP	1·062	13 —15	·51	·256	5·0	Ditto ..	Ditto	
Ditto	1·071	15·27—17·25	·60	·300	—	Ditto	Ditto	
RED HEREFORD	1·057	11·75—13·75	·25	·224	4·4	Ditto	Ditto	
Ditto	1·063	13·25—15·25	·26	·216	7·9	Ditto	Ditto	
RED JERSEY	1·063	13·25—15·25	·23	·332	3·3	H. Knight	Huntley	G.
RED STREAK	1·060	12·5 —14·5	·33	·436	3·4	C. Osborn	Woolston	S.
RED STYRE	1·058	12 —14	·29	·244	7·5	J. Davies	Marden	H.
Ditto	1·058	12 —14	·45	·384	5·0	H. Knight	Huntley	G.
RED ROYAL	1·071	15·25—17·25	·66	·308	12·0	Ditto	Ditto	
REINETTE DE CANADA ..	1·084	18·5 —20·5	·67	·376	8·9	R. Neville Grenville	Butleigh	S.
RENTON NATURAL	1·072	15·5 —17·5	·25	·312	6·0	J. W. F. Bickford ..	Barton	D.
REYNOLDS KERNEL	1·070	15 —17	·96	·244	5·4	H. Knight	Huntley	G.
ROMERIL	1·054	11 —13	·37	·226	5·4	J. C. Ahier ..	Jersey	
ROUGE BRUYÈRE	1·075	16·25—18·25	·23	·768	4·9	J. Hawkins ..	Brockley	S.
Ditto	1·076	16·5 —18·5	·82	·576	4·6	J. Davies	Marden	H.
ROYAL JERSEY	1·074	16 —18	·39	·436	16·0	R. Neville Grenville	Butleigh	S.
Ditto	1·067	14·25—16·25	·17	·356	3·4	C. Osborn	Woolston	S.
Ditto	1·072	15·5 —17·5	·38	·412	4·6	H. J. Davis ..	Sutton Montis	S.
ROYAL WILDING	1·062	13 —15	·57	·270	6·5	J. Davies	Marden	H.
Ditto	1·070	15 —17	·19	·320	6·6	H. Knight	Huntley	G.
RUSSET JERSEY	1·056	11·5 —13·5	·44	·476	9·7	Cider Institute ..	Long Ashton	S.
SADLER'S A 1	1·064	13·5 —15·5	·49	·158	5·3	A. Sadler	Lythecourt	D.

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.		Rate of Fermentation.	Grower.	District.	
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES—*continued*							
SADLER'S A 2	1·060	12·5 —14·5	·23	·200	3·8	A. Sadler	Lythecourt D.
Ditto A 3	1·066	14 —16	·18	·160	4·5	Ditto	Ditto
Ditto A 4	1·056	11·5 —13·5	·19	·756	3·8	Ditto	Ditto
Ditto A 5	1·065	13·75—15·75	·15	·258	6·9	Ditto	Ditto
Ditto A 6	1·077	16·75—18·75	·25	·422	9·3	Ditto	Ditto
Ditto K 1	1·056	11·5 —13·5	·23	·160	11·0	Ditto	Ditto
Ditto K 2	1·062	13 —15	·45	·236	12·0	Ditto	Ditto
Ditto K 3	1·048	9·5 —11·5	·80	·276	8·5	Ditto	Ditto
Ditto K 4	1·052	10·5 —12·5	·31	·184	8·5	Ditto	Ditto
Ditto R 1	1·059	12·25—14·25	·42	·186	3·0	Ditto	Ditto
Ditto R 2 (Woodbine)	1·058	12 —14	·36	·262	5·6	Ditto	Ditto
Ditto R 3 (Sweet Alford)	1·058	12 —14	·19	·188	3·4	Ditto	Ditto
Ditto R 4	1·076	16·5 —18·5	·63	·288	8·1	Ditto	Ditto
Ditto S 1	1·068	14·5 —16·5	·22	·202	4·2	Ditto	Ditto
Ditto S 2	1·060	12·5 —14·5	·18	·206	7·6	Ditto	Ditto
Ditto S 3	1·071	15·25—17·25	·17	·256	6·6	Ditto	Ditto
Ditto S 4	1·064	13·5 —15·5	·42	·150	11·2	Ditto	Ditto
Ditto T 1	1·071	15·25—17·25	·17	·332	10·8	Ditto	Ditto
Ditto T 2	1·058	12 —14	·48	·296	9·0	Ditto	Ditto
Ditto T 3	1·075	16·25—18·25	·43	·292	4·0	Ditto	Ditto
Ditto T 4	1·065	13·75—15·75	·74	·164	4·5	Ditto	Ditto
Ditto T 5	1·070	15 —17	·72	·328	9·8	Ditto	Ditto
SAM'S CRAB	1·063	13·25—15·25	·53	·152	2·1	J. Davies	Marden H.
Ditto	1·068	14·5 —16·5	·28	·236	6·5	Ditto	Ditto
SANDFORD JERSEY	1·077	16·75—18·75	·37	·608	5·5	H. J. Davis	Sutton Montis S.
Ditto	1·066	14 —16	·23	·532	4·2	Cider Institute	Long Ashton S.
Ditto	1·071	15·25—17·25	·27	·608	4·0	C. Osborn	Woolston S.
SANDFORD NATURAL	1·072	15·5 —17·5	·38	·480	15·0	J. W. F. Bickford	Barton D.

SARGENT	1·072	15·5 —17·5	·39	·864	10·0	H. J. Davis ..	Sutton Montis	S.
SHARP'S MIDSUMMER ..	1·068	14·5 —16·5	·92	·164	8·7	Cider Institute ..	Long Ashton	S.
SHARP'S SUMMER	1·065	13·75—15·75	·40	·270	7·0	Ditto	Ditto	
SILVER CUP	1·083	18·25—20·25	·21	·688	6·5	H. J. Davis ..	Sutton Montis	S.
SKYRME'S KERNEL	1·069	14·75—16·75	·66	·371	7·8	J. Davies	Marden	H.
Ditto	1·044	8·5 —10·5	·39	·228	3·1	J. Ford	Withington	H.
Ditto	1·067	14·25—16·25	·58	·432	5·6	H. Knight	Huntley	G.
SLACK MA GIRDLE	1·068	14·5 —16·5	·33	·148	5·1	E. T. Loram ..	Alphington	D.
Ditto	1·055	11·25—13·25	·27	·104	5·5	J. W. F. Bickford ..	Barton	D.
SOUTH QUEENING	1·047	9·25—11·25	·62	·176	8·2	J. Davies	Marden	H.
SPOTTED WHITE	1·068	14·5 —16·5	·34	·186	4·6	E. T. Loram ..	Alphington	D.
SPREADING NORMAN ..	1·067	14·25—16·25	·69	·212	8·1	J. Davies	Marden	H.
SPREADING REDSTREAK ..	1·071	15·25—17·25	·98	·152	4·1	Ditto	Ditto	
STEAD'S KERNEL	1·070	15 —17	·22	·316	12·5	Ditto	Ditto	
STRAWBERRY NORMAN ..	1·065	13·75—15·75	·38	·532	4·8	Ditto	Ditto	
Ditto	1·057	11·75—13·75	·28	·544	4·2	J. Bott	Breinton	H.
SWEET ALFORD..	1·062	13 —15	·16	·236	3·4	T. Baker	Chulmleigh	D.
Ditto	1·062	13 —15	·20	·236	2·9	E. T. Loram ..	Alphington	D.
Ditto	1·063	13·25—15·25	·34	·200	4·2	J. Crocker ..	Heatherleigh	D.
Ditto	1·055	11·25—13·25	·26	·220	3·7	E. T. Loram ..	Alphington	D.
SWEET FRENCH	1·059	12·25—14·25	·24	·308	6·0	H. Knight	Huntley	G.
SWEET HARCOMB	1·062	13 —15	·19	·356	3·1	C. Osborn	Woolston	S.
SWEET HEREFORD	1·067	14·25—16·25	·36	·432	7·8	J. Davies ..	Marden	H.
SWEET REDSTREAK	1·064	13·5 —15·5	·14	·388	4·4	H. J. Davis ..	Sutton Montis	S.
SWEET RUSSET	1·067	14·25—16·25	·21	·292	6·6	J. W. F. Bickford	Barton	D.
SYMES SWEET	1·074	16 —18	·26	·396	6·0	J. H. Symes ..	Martock	S.
TANNERS	1·067	14·25—16·25	·20	·688	4·1	R. Neville Grenville	Butleigh	S.
Ditto	1·070	15 —17	·71	·220	9·7	H. J. Davis.. ..	Sutton Montis	S.
TANNER'S RED	1·072	15·5 —17·5	·68	·248	5·4	J. Davies	Marden	H.
TARDIVE FORESTIER ..	1·069	14·75—16·75	·31	·344	12·4	J. Hawkins ..	Brockley	S.
TIPPLER'S KERNEL	1·058	12 —14	1·05	·312	2·2	H. Knight	Huntley	G.
TRACED HEREFORD ..	1·061	12·75—14·75	·23	·472	3·6	J. Davies	Marden	H.
TWISTBODY JERSEY	1·081	17·75—19·75	·32	·558	4·8	J. H. Symes ..	Martock	S.
UPRIGHT NORMAN	1·056	11·5 —13·5	·20	·196	4·7	J. Davies ..	Marden	H.
UPRIGHT REDSTREAK ..	1·074	16 —18	·73	·368	5·5	Ditto	Ditto	

Name of Variety.	Specific Gravity of Juice.	Percentage Composition of Juice.			Rate of Fermentation.	Grower.	District.
		Total Sugar. Approximate.	Malic Acid.	Tannin.			
APPLES—*continued.*							
VALLIS APPLE	1·058	12 —14	·34	·212	5·1	H. Knight	Huntley G.
WALLIS WHITE	1·042	8 —10	·58	·060	4·1	Ditto	Ditto
WHITE NORMAN	1·066	14 —16	·18	·472	3·5	J. Davies	Marden H.
WHITE CLOSE PIPPIN ..	1·065	13·75—15·75	·21	·356	12·7	H. J. Davis ..	Sutton Montis S.
WHITE JERSEY	1·069	14·75—16·75	·17	·256	4·9	C. Osborn	Woolston S.
Ditto	1·074	16 —18	·29	·242	—	H. J. Davis ..	Sutton Montis S.
WITHINGTON RED	1·059	12·25—14·25	·52	·344	6·0	J. Davies	Marden H.
WOOLSTON SPICE (Paradise) ..	1·060	12·5 —14·5	·29	·320	8·0	Cider Institute ..	Long Ashton S.
WORCESTER PEARMAIN ..	1.061	12·75—14·75	·46	·184	14·5	H. Ballard	Tenbury W.
YARLINGTON MILL	1·063	13·25—15·25	·21	·448	3·9	C. Osborn	Woolston S.
Ditto	1·065	13·75—15·75	·20	·420	4·0	H. J. Davis ..	Sutton Montis S.
YELLOW STYRE	1·066	14 —16	·73	·114	2·5	W. Wallis	Tewkesbury G.
PEARS—							
MOORCROFT	1·070	15 —17	·56	·222	4·2	T. May	Cheltenham G.
OLDFIELD	1·083	18·5 —20·5	·80	·032	10·4	Cider Institute ..	Long Ashton S.
PINE	1·074	16 —18	·48	·096	13·6	Ditto	Ditto

APPENDIX B.—Returns from Variety Trials of Apples, Pears, Plums, and Small Fruits in Plantations I. and II.

Name of Variety.		Yield in lbs. 1911.	Yield in lbs. 1909-10.
PLANTATION No. I.			
APPLES (Dessert)—			
Allington Pippin	27 bushes and 3 standards ..	546½	170
Beauty of Bath ..	„	41	16¾
Cox's Orange Pippin	„	119½	74½
Devonshire Quarrenden	„	61¾	32
King of the Pippins	„	468½	152¼
Worcester Pearmain	„	180¼	107¼
PEARS—			
Catillac	„	6¼	4¼
Doyenne Boussoch ..	„	36¼	55½
Louise Bonne de Jersey	„	78	137¾
Williams' Bon Chrétien	„	22¾	28¾

		Yield in lbs. 1911.	Yield in lbs. 1906-10.
GOOSEBERRIES—			
Crown Bob	90 plants	126	903¼
Keepsake ..	„	315¾	1713½
Lancashire Lad ..	„	383¼	1058¼
Whinham's Industry	„	722	1723½
RED CURRANTS—			
Fay's Prolific ..	90 plants	73¼	643
Knight's Sweet Red	„	99¾	572¾
Raby Castle ..	„	247¼	961
WHITE CURRANTS—			
White Dutch ..	90 plants	50	926½

APPENDIX B—*continued.*

Name of Variety.	Yield in lbs. 1911.	Yield in lbs. 1909-10.
PLANTATION No. II.		
APPLES—		
Bismarck .. 7 bushes and 3 standards ..	183¾	132¼
American Mother .. „	13½	4½
King's Acre Pippin .. „	135¼	21
Lady Sudeley .. „	11½	8½
Lord Grosvenor .. „	184½	85
Warner's King .. „	157	33¼
White Transparent .. „	61	8¾
Gascoyne's Scarlet Seedling „	17¼	—
Court Pendu Plat 10 bushes	35¼	5½
Frogmore Prolific .. „	147¼	53¾
James Grieve .. „	188¼	14
Lord Derby .. „	174¼	80¼
Peasgood's Nonsuch .. „	11¼	5¾
Potts' Seedling .. „	159	5¾
Rival .. .. „	70½	31¼
Sturmer Pippin .. „	144½	59½
Wealthy .. .. „	15	16½
Coronation .. .. „	40½	—
Golden Noble .. „	20	—
Lord Hindlip .. „	21¾	—
Royal Jubilee .. „	11¼	—
PEARS—		
Conference .. 7 bushes and 3 standards ..	11½	19½
Dr. Jules Guyot .. „	29¾	12¾
Hessle .. .. „	—	28½
Pitmaston Duchess .. „	2½	3
Bellissime d'Hiver 10 bushes	¾	6¾
Durondeau .. .. „	2½	½
Emile d'Heyst .. „	14½	16
Vicar of Winkfield .. „	½	—
Petite Marguerite .. „	½	—
PLUMS—		
Denniston's Superb 7 bushes and 3 standards ..	11½	6½
Pond's Seedling .. „	110¼	6¾
Early Transparent Gage „	43¾	6
Belle de Louvain .. „	26¾	—
Monarch .. 10 bushes	3	4½
Heron .. .. „	11¾	1
Early Rivers .. „	11	5
Czar .. .. „	29	5
Mallard .. .. „	6½	—
Late Orange .. „	12	—
Victoria .. .. „	50½	—

APPENDIX B—*continued.*

Name of Variety.	Yield in lbs. 1911.	Yield in lbs. 1909-10.
PLANTATION No. II.—*continued.*		
BLACK CURRANTS—		
Boskoop Giant 30 plants	27¾	72¼
Black Prince .. „	19¼	34¾
Goliath .. .. „	22¾	29
Ogden's Black .. „	43	67
Victoria .. .. „	19	37½
RED CURRANTS—		
Cherry .. 30 plants	14½	13¾
Comet .. .. „	3¼	19¼
La Fertile .. .. „	7¼	20½
La Hâtive .. .. „	10¼	13½
La Versailles .. „	11¾	23
New Red Dutch .. „	83¾	61
Red American .. „	29¼	15½
Red Grape .. „	8	12¾
Moore's Seedling .. „	7	8
La Transparent .. „	11¼	43¼
WHITE CURRANTS—		
White Dutch Cut Leaf 30 plants	10¾	41
White Transparent „	18¼	37
White Versailles .. „	16½	38

	Yield in lbs. 1911.	Yield in lbs. 1907-10.
RASPBERRIES—		
Abundance 150 plants	59¼	180
Baumforth's Seedling „	10¾	241¼
Carter's Prolific .. „	22¾	166½
Red Antwerp .. „	67½	294¾
Semper Fidelis (*a*) .. „	43¼	279¾
„ „ (*b*) .. „	47¾	145½
Lord Beaconsfield .. „	76¼	268¾

APPENDIX B—*continued.*

Name of Variety.	Yield in lbs. 1911.	1907-10.
PLANTATION No. II.—*continued.*		
GOOSEBERRIES—		
Blucher .. 20 bushes	15	33¼
Careless .. .. „	34	183½
Early Sulphur .. „	52½	49¼
Faithful .. .. „	53¾	142
Falstaff .. .. „	52	84¼
Fascination .. „	53½	168½
King of Trumps .. „	79¼	316¾
Leader.. .. .. „	32¼	134¾
Leveller .. .. „	15¼	172
May Duke .. .. „	58½	108½
Mount Pleasant .. „	16½	92½
Red Warrington .. „	57	112
Surprise .. .. „	69¾	175¼
Telegraph .. .. „	75¾	220¼
Golden Gem 10 bushes	29¼	32
Gretna Green .. „	69½	94¼
Dan's Mistake .. „	20½	21
Diadem .. .. „	40½	103¾
High Sheriff .. „	2	46
Hero of the Nile .. „	5¾	18
Langley Gage .. „	8½	131½
Ringer .. .. „	24¾	28½
Thatcher .. .. „	25	49¾
Victoria .. .. „	36¼	71
Red Champagne .. „	27½	43¾
Transparent .. „	23½	89½

APPENDIX C.

THE DATE OF BLOSSOMING OF VARIETIES OF APPLES, PEARS, PLUMS AND SMALL FRUITS.

Variety.	Date of Flowering.			
	1911	1910	1909	1908
APPLES.				
Market Varieties :—				
Bismarck	May 4	May 2	May 7	
Beauty of Bath	,, 5	,, 4	,, 7	May 6
White Transparent	,, 5	,, 2	,, 7	,, 11
Warner's King	,, 5	Apl. 30	,, 5	
Siberian Crab	,, 5	,, 24		
Lord Hindlip	,, 6	May 7	,, 8	
James Grieve	,, 6	,, 6	,, 5	,, 13
Devonshire Quarrenden	,, 7	,, 1	,, 6	,, 5
Worcester Pearmain	,, 7	,, 4	,, 7	,, 11
Stirling Castle	,, 7	Apl. 29	,, 6	,, 5
Bramley's Seedling	,, 7	May 10	,, 5	,, 1
Ecklinville	,, 8	,, 4	,, 7	,, 11
Allington Pippin	,, 8	,, 12	,, 7	
King of the Pippins	,, 8	,, 8	,, 6	,, 12
Blenheim Orange	,, 8	,, 12	,, 7	
Lord Suffield	,, 8	Apl. 29	,, 9	,, 10
Charles Ross	,, 8	May 7	,, 7	
Wealthy	,, 8	,, 1	,, 9	,, 12
Peasgood's Nonsuch	,, 8	,, 3	,, 10	
Keswick Codlin	,, 8	Apl. 29		
Sturmer Pippin	,, 8	May 4	,, 5	,, 9
Newton Wonder	,, 8	,, 14	,, 9	
Dartmouth Crab	,, 8	,, 8		
Cox's Orange Pippin	,, 9	,, 9	,, 9	,, 11
Lady Sudeley	,, 9	,, 18	,, 9	,, 14
King's Acre Pippin	,, 9	,, 8	,, 7	
Potts' Seedling	,, 9	,, 5	,, 10	
Frogmore Prolific	,, 9	,, 8	,, 9	
Lord Grosvenor	,, 9	,, 4	,, 9	
Houblon	,, 10	,, 13	,, 8	
American Mother	,, 10	,, 21	,, 9	
Rival	,, 10	,, 7	,, 11	
Lord Derby	,, 10	,, 12	,, 10	
Lane's Prince Albert	,, 10	,, 8	,, 11	,, 11
Golden Noble	,, 10	,, 17	,, 14	
Wellington	,, 10	,, 14	,, 10	
Royal Jubilee	,, 14	,, 18	,, 14	,, 27
Court Pendu Plat	,, 15	,, 24	,, 14	
Coronation	,, 15	,, 19	,, 14	
Vintage Varieties :—				
M. Jacques (Free stock)	,, 7	,, 5	,, 10	
Cap of Liberty (Free stock)	,, 7	,, 9	,, 11	
Court Royal (Free stock)	,, 8	,, 6	,, 11	

APPENDIX C—*continued.*

Variety.	Date of Flowering.			
	1911	1910	1909	1908
APPLES—*continued.*				
Jones' Seedling (Free stock)	May 9		May 10	
Knotted Kernel (Free stock)	,, 9	May 5	,, 13	
Eggleton Styre (Free stock)	,, 9	,, 5	,, 11	
Chisel Jersey (Free stock)	,, 9	,, 9	,, 11	
Dymock Red (Free stock)	,, 9		,, 11	
Pride of Australia (Free stock)	,, 9		,, 8	
Ecarlatine (Free stock)	,, 10	,, 9	,, 12	
Bramtôt	,, 10			
Cardive Forestier	,, 10			
Maggs' Seedling (Free stock)	,, 10		,, 11	
Cremière	,, 10			
Stuart's Seedling (Free stock)	,, 11	,, 9	,, 11	
Fréquin Rouge	,, 11	,, 4	,, 8	
Victoria	,, 11			
Thomas Hunt	,, 11	,, 17	,, 11	
Sweet Alford	,, 11			
Cowarne Red	,, 11	,, 16	,, 11	May 19
Dymock Red	,, 11	,, 14	,, 9	,, 22
M. Jacques	,, 11	,, 2	,, 8	,, 11
Cummy Norman	,, 11			
Brown Jersey	,, 11			
Foxwhelp (Free stock)	,, 11	,, 9		
Sharpe's Midsummer (Free stk.)	,, 12			
Maggs' Seedling	,, 12			
Rousse	,, 12			
No. 42	,, 12			
Doux Amere	,, 12			
Rouge de Trèves	,, 12			
Reinette Obry	,, 12			
Improved Pound	,, 12			
Kingston Black Improved	,, 12	,, 17	,, 11	
Major	,, 12	,, 20	,, 13	
Silver Cup	,, 12			
Knotted Kernel	,, 12			
White Bache	,, 12			
Somerset Redstreak	,, 12			
Royal Jersey (Crofts)	,, 12			
White Norman	,, 12			
Dabinett (Free stock)	,, 12	,, 14	,, 17	
Kingston Black (Free stock)	,, 12	,, 12	,, 13	
Cherry Pearmain (Free stock)	,, 12	,, 11		
Cremière (Free stock)	,, 12	,, 12	,, 12	
Sweet Alford (Free stock)	,, 12	,, 14	,, 19	
Doux Amer (Free stock)	,, 12	,, 17	,, 12	
Cap of Liberty	,, 13			
Fréquin Audievre	,, 13			
Sandford Jersey	,, 13			
Redstreak	,, 13	,, 17	,, 9	,, 19
Skyrme's Kernel (Free stock)	,, 13	,, 15	,, 19	,, 22
Rienette Obry (Free stock)	,, 13		,, 17	

APPENDIX C.—*continued.*

Variety.	Date of Flowering.							
	1911		1910		1909		1908	
APPLES.—*continued.*								
Red Manse	May	13						
Royal Jersey (Free stock)	,,	13	May	19				
Cowarne Red (Free stock)	..	13	,,	14	May	17		
White Jersey	,,	13	,,	20	,,	15	May	22
Royal Wilding	,,	13	,,	19	,,	13		
Tardive Forestier	,,	13						
White Jersey (Free stock)	..	14	,,	17				
Royal Jersey	,,	14	,,	22	,,	11	,,	6
Chevalier	,,	14	,,	16	,,	17		
Yarlington Mill (Free stock)	,,	15	,,	14				
Woodbine	,,	15						
Dabinett	,,	16	,,	15	,,	13	,,	22
Footlands No. II.	,,	16						
Yarlington Mill	,,	16	,,	17	,,	13	,,	19
Red Foxwhelp	,,	16						
Woolston Spice	,,	16						
Osborn's Cadbury	,,	16						
Broadleaf Jersey (Free stock)	..	17						
Bédans des Partes	,,	17						
Harry Masters (Free stock)	,,	17	,,	20	,,	22		
Kingston Black	,,	17						
Médaille d'Or	,,	17	,,	22	,,	18	,,	31
Strawberry Norman	,,	17						
Médaille d'Or (Free stock)	,,	18			,,	20		
Umbrella	,,	18						
Philip Norman	,,	18						
Strawberry Norman (Free stk.)	,,	19	,,	21	,,	19		
Bédans des Partes (Free stock)	,,	20	,,	17				
NOTE.—Except where otherwise stated the above records were taken from bush trees on the Paradise stock.								
PEARS.								
Market Varieties :—								
Louise Bonne de Jersey	Apl.	13	Apl.	3	Apl.	20	Apl.	22
Emile d'Heyst	,,	19	,,	15	,,	28	May	1
Conference	,,	20	,,	15	May	1		
Williams' Bon Chrétien	,,	21	,,	14	Apl.	28	Apl.	30
Vicar of Winkfield	,,	21	,,	13				
Beurré d'Amanlis	,,	21	,,	13	,,	28	May	1
Doyenné Boussoch	,,	22	,,	13	,,	24	Apl.	28
Petite Marguerite	,,	25	,,	23	May	1		
Dr. Jules Guyot	,,	26	,,	18	,,	3	May	3
Durondeau	,,	27	,,	24	Apl.	26	,,	1
Pitmaston Duchess	,,	28	,,	21	May	3	,,	3
Catillac	,,	29	,,	22	,,	3	,,	3
Hessle	,,	29	,,	21	,,	3		
Bellissime d'Hiver	,,	29	,,	13	Apl.	26	,,	1
Triomphe de Vienne			,,	25	May	4		

APPENDIX C—*continued.*

Variety.	Date of Flowering.			
	1911	1910	1909	1908
PEARS—*continued.*				
Vintage Varieties :—				
Pine	Apl. 24	May 1		
Moorcroft	May 3	,, 1	Apl. 30	May 3
Oldfield	,, 3	,, 1	May 5	,, 3
Barland	,, 4	Apl. 30		
Port	,, 4			
Taynton Squash	,, 4	,, 30	Apl. 30	,, 3
PLUMS.				
Mallard	Apl. 13	Apl. 10	Apl. 17	Apl. 19
Jefferson	,, 14			
Monarch	,, 14	,, 15	,, 17	,, 30
Heron	,, 17	,, 15	,, 18	,, 30
Early Prolific	,, 18	,, 20	,, 22	,, 29
Denniston's Superb	,, 19	,, 20	,, 22	,, 30
Early Transparent Gage	,, 19	,, 20	,, 22	,, 30
Victoria	,, 19	,, 19	,, 22	May 1
Late Orange	,, 19	,, 25	,, 19	
President	,, 20	,, 23	,, 28	,, 1
Czar	,, 21	,, 17	,, 23	Apl. 30
Pond's Seedling	,, 23	,, 27	,, 26	
Belle de Louvain	,, 24			
Goliath	,, 25			
BLACK CURRANTS.				
Goliath	Apl. 24	Apl. 24	Apl. 29	
Victoria	,, 26	,, 28	,, 29	
Black Prince	,, 26	,, 24	,, 27	
Boskoop Giant	,, 27	,, 27	,, 30	
Ogden's Black	,, 30	,, 24	,, 30	
RASPBERRIES.				
Carter's Prolific	May 31		May 27	
Red Antwerp	,, 24	May 25	,, 28	
Yellow Antwerp	,, 24		,, 26	
Abundance	,, 25	,, 25	,, 28	
White Magnum Bonum	,, 25		,, 26	
Lord Beaconsfield	,, 26	,, 25	,, 26	
Baumforth's Seedling	,, 26	,, 24		
Semper Fidelis	,, 27	,, 25	,, 28	
STRAWBERRIES.				
Royal Sovereign	Apl. 9	Apl. 14	Apl. 12	
Leader	,, 10	,, 10	,, 14	
Sir C. Napier	,, 10	,, 13	,, 11	

APPENDIX C.—*continued.*

Variety.	Date of Flowering.			
	1911	1910	1909	1908
STRAWBERRIES—*contd.*				
Stirling Castle	Apl. 10	Apl. 19	Apl. 10	
Scarlet Queen	,, 10	,, 16	,, 13	
Auguste Nicaise	,, 11	,, 9	,, 11	
Louis Gauthier..	,, 11	,, 18	,, 9	
Keen's Seedling	,, 11	,, 9	,, 11	
St. Antoine de Padoue ..	,, 11	,, 9	,, 12	
St. Joseph	,, 12	,, 13	,, 11	
Queen of Denmark	,, 12	,, 16	,, 14	
Laxton's Fillbasket	,, 15			
Elton Pine	,, 16		,, 23	
Dr. Hogg	,, 16	,, 15	,, 14	
Trafalgar	,, 17		,, 17	
British Queen	,, 17	,, 16	,, 17	
President Loubet	,, 18		,, 20	

Variety.	Date of Flowering 1911	Varieties.	Date of Flowering 1911
GOOSEBERRIES.		GOOSEBERRIES—*ctd.*	
Keepsake	Mar. 27	Thatcher	Apl. 18
Langley Gage	,, 27	Ringer	,, 19
King of Trumps	,, 30	Leader	,, 20
Whinham's Industry ..	Apl. 2	Surprise	,, 21
Crown Bob	,, 2		
May Duke	,, 2	RED CURRANTS.	
Mount Pleasant	,, 2	Fay's Prolific	Apl. 22
High Sheriff	,, 8	Wilder	,, 22
Telegraph	,, 8	Knight's Sweet Red ..	,, 23
Early Sulphur	,, 10	Cherry	,, 23
Red Warrington	,, 10	La Versailles	,, 23
Gretna Green	,, 12	La Fertile	,, 24
Lancashire Lad	,, 13	Comet	,, 24
Blucher	,, 14	La Transparent	,, 27
Victoria	,, 14	La Hâtive	,, 29
Careless	,, 14	Red Cross	May 1
Golden Gem	,, 15	New Red Dutch ..	,, 1
Red Champagne ..	,, 15	Wentworth Leviathan ..	,, 2
Faithful	,, 15	Raby Castle	,, 7
Falstaff	,, 15		
Leveller	,, 16	WHITE CURRANTS.	
Diadem	,, 16	White Dutch	Apl. 22
Hero of the Nile ..	,, 17	German White	,, 24
Dan's Mistake	,, 17	White Transparent ..	,, 22
Fascination	,, 17	White Dutch Cut-leaved	,, 25
Transparent	,, 18	White Versailles ..	,, 27

APPENDIX D.—Reports on the Trial Orchards Planted 1908–11.

The following reports on the trial orchards planted during the past three seasons have been received.

Gloucester.—Mr. G. H. Hollingworth, County Instructor in Horticulture, reports as follows:—I have pleasure in supplying the following information in respect of three orchards at Berkeley, Hardwicke, and Lydney, planted in the autumn of 1908, and two orchards at Tibberton and Dymock planted early in 1910.

The orchard at Berkeley is making satisfactory progress, most of the trees having done remarkably well since they were planted. The experiment of cultivating the ground for a distance of 2 feet from the stem in the case of the majority of the trees, and allowing the grass to grow over the roots of others is still going on, and results so far are distinctly in favour of cultivation, as the specimens so treated are larger in the head and bigger in the girth than those over the roots of which the turf was replaced.

A similar experiment as the above is being carried on in the orchard at Hardwicke, but the difference was so great that in the interests of the future of the trees the number of turfed specimens has been reduced to one of each variety. As a whole the trees in this orchard look distinctly promising, and they show unmistakeably the effects of careful planting, proper protection and judicious pruning.

The selection of the site for the orchard at Lydney was a happy one, if the steady growth that the trees are making may be accepted as evidence. Even Cowarne Red, which is a splendid cider apple, but very prone to canker in many places, is showing scarcely any sign of the trouble here; and with one or two exceptions the remainder of the trees are in a flourishing condition.

The time is now approaching when a number of the trees in the above orchards will begin to bear some fruit, and, as the heads are mostly well formed, pruning is confined to the removal of superfluous growth.

Owing to the exceptional drought last season the young trees in the orchard at Tibberton which were cut back in the spring, did not make so much growth as they would have done if the conditions had been less dry, but they, nevertheless, made a fair start. Most of the trees of Cowarne Red in this orchard have fallen a victim to canker, and other specimens of strong growing habit planted in place of the failures are being head-worked with that variety. By adopting this method we hope to establish Cowarne Red in the orchard.

The dry weather last year had some effect on the growth made by the perry pear trees in the orchard at Dymock, which were pruned for the first time in the spring; and the new shoots are not so strong as they would have been, had more favourable conditions prevailed. The trees, however, are doing well, with the exception of the Barland variety. I am not very sanguine about this pear, as it shows an inclination to canker, and some of the young shoots are dying back at the ends.

Monmouth.—The following report, prepared by Mr. W. J. Grant, Director of Agricultural Education, has been passed by the Monmouthshire Education Committee:—The cider and perry orchards that have been partially planted at Croesheolydd, Bassaleg, Sunny Bank, Rhiwderin, Llansaintfraed, Tre Owen, Dingestow, Itton, Tyllwyd, Llangwm, and Pentwyn Llantilio Crossenny, have made satisfactory progress with the exception of the latter. The completed perry orchard at the Hendre, with the exception of a few trees, is in a very satisfactory condition. In every instance the ground has been carefully forked round the young trees, and in several cases the trees have been again well mulched with farmyard manure.

The young perry pear trees at Old Pandy Mill, Itton, and Llanddewi Court, Abergavenny, did not make satisfactory progress last season, while some of the varieties planted show a tendency to canker. It is, however, hoped that careful treatment with Lysol, to which all the affected trees have been subjected, will, in a great measure, eradicate the attack of this pest.

In addition to the above, the trees presented last season by the National Fruit and Cider Institute to complete the planting of a small orchard at Plas Newydd, Llantarnam (Mr. L. Lawrence), and to commence the planting of a perry orchard at Old Court, Llangattock Lingoed (Mr. Warren Davies), have done well: while in February last a small orchard of cider apples was planted at Twyn-y-ruthin (Lord Llangattock).

In addition to the trees presented by the National Fruit and Cider Institute, there have been received through the Institute, from the Board of Agriculture and Fisheries and the Bath and West Society, sufficient standard cider apple and perry pear trees to complete the planting of five orchards, and to commence the planting of nine others, making a total of fourteen, which justifies the hope that within the course of a few years an addition of at least fifty odd acres of excellent orcharding will be added to the orchards of Monmouthshire.

Devon.—Mr. C. Berry, County Instructor in Horticulture, has supplied the following report:—

Killerton (Sir Thomas Dyke Acland).—I have recently pruned the trees. With one or two exceptions the trees are doing well. Black Foxwhelp made strong growths; healthy and strong. Improved Pound: many growths that were cut off were 2ft. to 2ft. 6in. long. The habit of growth is irregular, somewhat like Warner's King; very healthy. Medaille d'Or: strong growers, one tree produced forty-five prunings—50ft. of wood. Doux Amer: good shape, upright, early buds; small. Yarlington Mill: one tree produced 60ft. of wood, averaging a little over 1 foot long each pruning (piece cut off). Cap of Liberty: most fruit buds, and best tree; the tree not pruned since planted. Only a little damage by loose tree-tying; rather the cords wore through.

The best of the Devon trial orchards. No grass is allowed to grow; the land is cultivated and cabbages for cattle are grown, but not close to trees.

Kingsnympton.—The trees have made less growth than those at Killerton. The soil at Killerton is better. About three fresh trees will be wanted next autumn to take the places of those that died of canker. The grass is not kept down, and I find it difficult to get the tenant to see the good of hoeing the surface for a few years. Some trees got loose and suffered during the very windy season. This orchard lies by the river Tone. I think that a smaller growth here will not be a bad thing, for the wood will, perhaps, become well-ripened.

Okehampton (General Holley).—The trees are well looked after, the surface soil is hoed in the case of two rows, and the land of the third row is cultivated. This latter row is the best; but the steward thinks that is due to being near a hedge which breaks the wind from west-by-north. It may be, but the gardener and I think that some good is got from the width of soil ploughed (about a rod wide).

Ashprington.—The farm has been sold, since planting the trees, to the tenant, Mr. Peeke, who will not hoe the surface soil, telling me that it is not the custom here, and it cannot be done. Mr. Peeke promised me that the trees should be re-tied and made fast to supports. Of course so warm a summer as 1911 caused loss of growth to the trees, because the dew was used by the grass-roots and leaves rather than by the trees. I have not pruned this orchard this year. I will pay some attention this summer to it and report again.

Branscombe.—The soil is rather light and thin, and forms a slope to the west. The trees have not made much growth, but they are putting in fruit-buds. They did not require much pruning. I have asked Mr. Ford, the owner, to put on some nitrate of soda, which will cause, I think, more growth. During 1912 in Branscombe Mr. Ford tells me that no "roots" were produced. It will be understood how dry the soil was throughout the summer. The trees are all growing a little. This orchard will teach some lessons of importance as we get manures at work on it.

Worcester.—The following reports have been collected by Mr. A. Weston Priestley, Director of Education.

Madresfield.—Mr. C. de Wilson writes: I am glad to be able to give you an excellent report on the orchards planted with trees from the National Fruit and Cider Institute, and I should be very glad for a representative from the County Council to come and inspect them any time. They are quite close to this office, and I could arrange to show the trees any day by appointment.

Staunton.—Mr. J. G. Hawkins reports: About six of these died in autumn owing no doubt to the excessive drought; the others are looking extremely healthy and grow fast. As they are planted in turf I have removed it for about a yard and keep the ground free of weeds and grass round each.

Suckley.—Mr. J. H. W. Best writes: The trees I had from the Cider Institute are growing satisfactorily, but as I remarked in my last report it is a great pity to send out low standard trees for grass. They should all be 6ft. 6in. high.

Upton-on-Severn.—Mr. W. S. Lane sends the following report: I have little to add to my report of last year. The summer drought of 1911 was responsible for the death of very many trees in this neighbourhood, but I believe the whole of the 50 stocks received from Long Ashton are well alive and appear quite vigorous. With a favourable season the trees should now make good growth and soon come into bearing.

Woollas Hill, Pershore.—Mr. J. William Dee reports: In reply to your enquiry as to apple and pear stocks I had from the County Council three years ago, they have done remarkably well. I never saw trees do better. They had some fruit on last year and now look very promising. I am very pleased with them.

Powick.—Mr. G. F. S. Brown reports as follows:—I was instructed by my Committee at their meeting on Monday last to inform you in

reply to your letter of the 23rd ult. that the trees sent from the Institute were doing well.

Newnham Court, Tenbury.—Mr. E. V. V. Wheeler reports : All the trees from the National Fruit and Cider Institute planted on my land are alive, and those first planted are now becoming nice trees. Some of the last sent have been broken by cattle owing to their being too short in the stem. I have, however, trimmed them up, and they will, I think, make new heads which will be rather higher. This mistake of cutting the trees off earlier is fatal. A tree should be allowed to grow in the nursery until it is possible to form a head at least 6 feet from the ground. The branches will then be practically safe from cattle. Although in theory, I know, fruit should be grown on trees with short stems, and on tillage land, in practice cider apples will always be grown on grass land grazed with stock, firstly because the crop is not sufficiently valuable to justify the use of the best land for its production or the great expense of hand cultivation necessary for low trees, and secondly, because if this fruit drops, as cider fruit generally does, it is much less damaged by falling on the grass than on cultivated ground. I hope if the Institute grow any more cider trees in their nursery they will be grown with at least 6 feet clear stems. So far with the exception of one apple on a Broadleaf Norman tree I have had no fruit on any.

Moor.—Mr. Oldham writes as follows :—The trees are doing well. As stated in last year's Report the stocks are too short for grass land.

Somerset.—Mr. John Ettle, County Instructor in Horticulture, has furnished the following report :—

The season of 1911 was an extremely trying one through the prolonged drought, but with one exception which I mention below we had comparatively few losses. The most pleasing feature about the orchards is to see how well the perry pear trees are thriving, growing more quickly and showing more prospect of early fruiting than the apple trees. This is gratifying to us as there was a doubt expressed as to whether the pears would do in the county, where, although I know the county fairly well, I have not found one old perry pear orchard. This is surprising, seeing that there are so many in the neighbouring counties of Gloucester, Worcester and Hereford.

At Clutton, on Mr. H. Gibbons' farm, all trees with the exception of a few Kingston Blacks are doing very well, having been pruned and generally looked after by Mr. Gibbons, jun.

With Mr. Masters, Barton St. David, Cowarne Reds and Skyrme's Kernel are not at all satisfactory, as they take canker rather badly. Pears are growing very freely; so are Eggleton Styre and Sweet Coppin Apples.

Mr. H. House, Christon Court, Axbridge, lost several trees last year through the drought. The soil, although good, dries very rapidly, and so early in the season as to-day, April 30th, when I visited the orchard, I saw the soil was cracking and drying up.

In Messrs. Tilley's orchard at Shepton Mallet a few trees, planted in January, 1911, have died. This is not at all surprising, as the field faces due south and the soil overlies rock. Here again the pears are growing more satisfactorily than the apples.

Mr. Eldred G. F. Walker, who has a perry orchard, reports that all trees are doing well. As regards pruning he finds that pears do much better by not being cut back the first season after planting.

At Mr. Frank Body's, Brent Knoll, where pears only were planted two years since, all are growing well.

Woolston, Somerset.—Mr. C. Osborn writes: I am pleased to be able to report that the apple and pear trees are all doing well and making excellent progress, last season's growth of young wood being quite normal, notwithstanding the severe drought. The general healthy appearance of the trees is very noticeable.

Butleigh, Somerset.—Mr. R. Neville Grenville sends the following report: The trees are all doing well except about three, which died. They are not doing so well as the trees of the same age and under the same conditions are that we grew here on Morgan Sweet stocks.

Frampton Cotterell, Gloucester.—Mr. J. P. Eley writes as follows: I beg to report that the cider fruit trees which were supplied by the Institute are going on very well. Unfortunately owing to the prolonged drought of last year, there are five dead, but when the extraordinary weather is taken into consideration, it is surprising that the trees stood it so well. The whole of the trees have been pruned. During the month of January last a demonstration in pruning was given by Mr. G. H. Hollingworth, County Instructor in Horticulture. It was well attended by local people interested in fruit culture. We are now soon grafting Morgan Sweet stocks with dessert and culinary varieties alongside the cider fruit trees, and it will be interesting to see the results of the growth of the two lots of trees.

Aspall Hall, Suffolk.—Mr. J. B. Chevallier's report is as follows: In February, 1911, the trees were sprayed with Sodalin and Sulphate of Copper. In April, before the blossom opened, they were treated with Herrod's Apple Sucker and Aphis Wash; but as the trees seemed unusually affected by these pests, they were again sprayed with the same wash in the early part of May, and practically cleared of the attack.

The orchard was also treated for scab with Herrod's Apple and Pear Scab, Brown Rot and Caterpillar Paste.

The prevalence of apple saw-fly demanded thorough examination of the trees in July and all affected fruits were picked off and burnt.

There was a nice crop of fruit on the bush trees, the skin being clean and free from scab. There was no fruit on the cider apple trees, which, however, as regards spraying and manuring, received the same treatment as the others to prevent pests and fungus diseases spreading. The standards are growing satisfactorily.

In December, 1911, the orchard received a dressing of Basic Slag, 5 cwts. per acre, and in February, 1912, farmyard manure at the rate of 20 loads per acre. During February, 1912, the trees were sprayed with lime and sulphur, and will be treated with Herrod's Aphis Wash and Apple Scab Wash during the spring as required.

Another four acres adjoining the above have been planted with bush apple trees—Bramley's Seedling, Lane's Prince Albert, and Grenadier,—black currants being interposed in the same rows.

Two lines of cordon trees, about 200 in each, of various kinds, have been also added, extending from the top to the bottom of the field. The whole orchard now comprises ten acres.

Harper-Adams College, Newport, Shropshire.—Principal P. Hedworth Foulkes, B.Sc., has sent the following report: The cider and perry trees have done remarkably well during the past season (1911). Growth was vigorous and clean, while fruit buds have formed freely on all varieties. Last year some of the apples fruited, Médaille d'Or producing a good crop. Winter and summer spraying has been carried out as usual, and the trees are free from insect and fungoid pests. Pruning was completed by the middle of January, and all the trees now have well-balanced heads. The pears have made much stronger growth than the apples, and should produce a fair quantity of fruit this year.

Loders, Dorset.—The report of Mr. E. C. Parslow, County Instructor in Horticulture, is as follows: The majority of the trees continue to make satisfactory progress, and most of them have

again been lightly pruned. The notable exception is Foxwhelp, which makes no headway, and on this soil is apparently not worth growing. Unless the coming season shows an improvement this variety will be grafted next Spring.

There is a little canker in evidence, due largely, no doubt, to the proximity of old trees. Broadleaf Norman appears most susceptible, and one tree has had to be cut down entirely. Any wounds will be dressed at intervals during the season, and this variety left entirely unpruned next season and also treated with lime at the roots.

So far, H. Emulsion painted on the wounds appears to hold canker in check.

The best growers are Broadleaf Norman, Virgin Mary, Cremière, Court Royal, and Rouge de Trèves. There is a fair development of fruit spurs, but the trees are not allowed to bear more than a few fruits each.

Sherborne, Dorset.—Messrs. Rawlence and Squarey report as follows: We are sorry to say that our tenant has allowed a goat to gnaw several of the trees, which has naturally impeded their growth, and has in some cases killed them.

Those trees that are uninjured are looking healthy and breaking out satisfactorily, but as they are close by the River Yeo apparently the frosts have kept them back considerably. We could notice no sign of canker in any of them.

Hereford.—Mr. A. J. Manning, County Instructor in Horticulture, has supplied the following report: The orchard at Burghill still continues to do well, the trees having made from 1½ to 3 feet of growth during the past summer notwithstanding the long drought and in spite of the grass having been mown for hay each year.

All the varieties, except Cowarne Red, are making healthy growth, but this variety is very disappointing. Only three trees of the eleven planted are growing as they should do, five having died outright and all the others having developed canker on the main stem.

Quite a number of the other kinds were also affected with canker last year, but all the wounds have been pared as deeply as the disease had penetrated and the exposed wood covered with grafting wax. Many of the wounds that were small have healed over, and I think the majority will have done so by the end of this coming summer.

Mussel Scale made its appearance last summer; but I think short work has been made of them, the trees after pruning having been sprayed with Caustic Soda, 2lbs. in 10 gallons water. The greater

portion have shrivelled and fallen, and the remainder, I think, will do so.

Last season I mentioned an experiment on pruning these trees after planting, *i.e.*, one-third being pruned immediately after planting, one-third about the end of June, and the remaining third not until the winter after planting, when of course all were pruned and have been every winter since.

The effect of this experiment is showing up quite markedly this season, and, if a favourable blossoming time is granted us this spring, it is proposed to invite the public to come and inspect the results. Almost every tree is promising blossom, but the trees cut back in the summer are taking the lead rapidly of those of the other two methods of pruning.

The trees on the Small Holdings estates at Leominster are not doing so well as at Burghill, several of those planted last spring to replace casualties having also died. They were planted so late that they had very little chance of becoming established. On one holding about one-fifth of the trees have been allowed to perish, on the other two the trees are being cared for.

The Perry Pears planted at Berrington have done remarkably well, many having made 30 inches of growth. It promises to become a very successful orchard.

APPENDIX E.—NEW EXPERIMENTAL ORCHARD PLANTED IN 1911.

CENTRE.	VARIETIES SELECTED.			
	APPLES.			PEARS.
	Sharp.	Sweet.	Bittersweet.	
Monmouth County Trees. The Hendre	Redstreak (10) Kingston Black (5) Cap of Liberty (5) Dymock Red (5)		Knotted Kernel (15) Silver Cup (4) Royal Wilding (4)	Barnet (5) Butt (1) Claret (2) Port (1)